Housatonic River Watershed Summary

Housatonic River, Lake Zoar, Lake Housatonic, and Curtiss Brook

WATERSHED DESCRIPTION AND MAPS

The Housatonic River watershed covers an area of approximately 112,171 acres in the western portion of Connecticut (Figure 1). The watershed extends north into Massachusetts and west into New York. There are multiple towns located at least partially in the watershed, including the municipalities of Salisbury, Canaan, North Canaan, Sharon, Cornwall, Kent, Warren, New Milford, Bridgewater, Brookfield, Sherman, Southbury, Newtown, Oxford, Monroe, Shelton, Seymour, Derby, Stratford, Milford, and Orange, CT.

The Housatonic River subregional watershed includes four segments impaired for recreation due to elevated bacteria levels. These segments were assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. Some segments in the watershed are currently unassessed as of the writing of this document. This does not suggest that there are no issues on these segments, but indicates a lack of current data to evaluate the segments as part of the assessment process. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of some of the other waterbodies in the watershed (CT DEEP, 2010). Curtiss Brook is not shown in Table 1 because the impairment is based on sampling data from 2010. The segment will be included in the 2012 list.

The Housatonic River begins in western Massachusetts and flows south into Connecticut initially forming the town boundary between North Canaan and Salisbury, CT. The bacteria impaired segment (CT6000-00_06) consists of 18.23 miles of the river in Salisbury, Canaan, Sharon, Cornwall, and Kent, CT (Figures 2 and 7). This impaired segment of the Housatonic River begins at the Great Falls outlet dam at the Salisbury-Canaan town border, flows south, and ends at the confluence with Mauwee Brook near River Road in Kent (Figure 2 and 7).

Impaired Segment Facts

Impaired Segments:
1. Housatonic River (CT6000-00_06)
2. Lake Zoar (CT6000-00-05+L2_01)
3. Lake Housatonic (CT6000-00-05+L4_01)
4. Curtiss Brook (CT6000-73_01)

Municipalities: Salisbury, Canaan, Sharon, Cornwall, Kent, Southbury, Newton, Oxford, Monroe, Shelton, Seymour, and Derby

Impaired Segments and Lengths /Area (miles / acres): 6000-00_06 (18.23 miles), 6000-00-05+L2_01 (580.57 acres), 6000-00-05+L4_01 (349.29 acres), and 6000-73_01 (0.8 miles)

Water Quality Classifications: Class AA (4), Class B (1-3)

Designated Use Impairments: Recreation

Sub-regional Basin Name and Code: Housatonic River, 6000

Regional Basin: Housatonic Main Stem

Major Basin: Housatonic

Watershed Area (acres): 112,171

MS4 Applicable? Yes

Applicable Season: Recreation Season (May 1 to September 30)

Figure 1: Watershed location in Connecticut

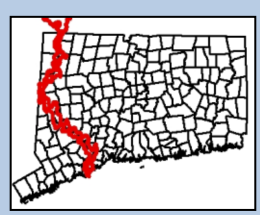


Table 1: Impaired segments and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles/ Acres	Aquatic Life	Recreation	Fish Consumption
CT6000-00_01	Housatonic River-01	From end of saltwater influence, at southern most portion of Wooster Island, Orange, US to confluence with Naugatuck River, Shelton/Derby town border.	3.17	U	NOT	FULL
CT6000-00_02	Housatonic River-02	From confluence with Naugatuck River, US to Lake Housatonic outlet dam (Derby Dam), Shelton/Derby town border. (Between segment 02 and 03, are Lake Housatonic, Lake Zoar, and Lake Lillinonah, all independent waterbodies).	1.5	U	NOT	FULL
CT6000-00_03	Housatonic River-03	From inlet to Lake Lillinonah (Northwestern most portion, DS of Lovers Leap Road crossing), at confluence with Town Farm Brook, New Milford/Bridgewater town border, US to Boardman Road crossing (between Route 7 and Railroad tracks), New Milford.	5.09	U	FULL	NOT
CT6000-00_04	Housatonic River-04	From Boardman Road crossing (between Route 7 and Railroad tracks), New Milford, US to Bull Bridge outlet dam (US of Bulls Bridge Road crossing, west side of Route 7), Kent.	8.05	U	NOT	NOT
CT6000-00_05	Housatonic River-05	From Bull Bridge OUTLET dam (US of Bulls Bridge Road crossing, west side of Route 7), US to confluence with Mauwee Brook (between River Road on west side, and Railroad tracks on east), Kent.	6.66	U	U	NOT
CT6000-00_06	Housatonic River-06	From confluence with Mauwee Brook (between River Road on west side, and Railroad tracks on east), Kent, US to Great Falls outlet dam, Salisbury/Canaan (Amesville) town border. (Segment follows river channel, not concrete passage from dam).	18.23	FULL	NOT	NOT
CT6000-00_07	Housatonic River-07	From Great Falls outlet dam, Salisbury/Canaan (Amesville) town border (river channel, not concrete passage from dam), US along Salisbury/North Canaan town border to Massachusetts border.	7.34	U	U	NOT

Table 1: Impaired segments and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report (continued)

Waterbody ID	Waterbody Name	Location	Miles/ Acres	Aquatic Life	Recreation	Fish Consumption
CT6000-00-5+L2_01	Zoar, Lake (Monroe/ Newtown/ Oxford/ Southbury)	From Stevenson Dam, Oxford/Monroe, US to a line drawn between DEP Lake Zoar wildlife area boat launch on northeast shore in Southbury, across to just DS of confluence with Gelding Brook on southwest shore in Newtown (Riverside).	580.57	FULL	NOT	NOT
CT6000-00-5+L2_02	Zoar, Lake (Newtown/ Southbury)	From a line drawn between DEP Lake Zoar wildlife area boat launch on northeast shore in Southbury, across to just DS of confluence with Gelding Brook on southwest shore in Newtown (Riverside), US approximately 5 miles to Shepaug dam (L. Lillinonah).	339.25	FULL	FULL	NOT
CT6000-00-5+L4_01	Housatonic, Lake (Shelton/ Derby/ Seymour/ Oxford/Monroe)	From Lake Housatonic Dam (Derby Dam), US to Stevenson Dam (division of lower Lake Zoar and upper Lake Housatonic) Oxford/Monroe. First major impoundment of Housatonic River.	346.29	FULL	NOT	NOT
Shaded cells indicate impaired segment addressed in this TMDL **FULL = Designated Use Fully Supported** **NOT = Designated Use Not Supported** **U = Unassessed**						

The impaired segment of the Housatonic River has a water quality classification of B. Designated uses include habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. This segment of the river is impaired due to elevated bacteria concentrations, affecting the designated use of recreation. As there are no designated beaches in this segment of the Housatonic River, the specific recreation impairment is for non-designated swimming and other water contact related activities.

The other three impaired segments in the Housatonic River watershed include two lakes, which are impoundments of the Housatonic River (Lake Zoar and Lake Housatonic) and a tributary stream to the Housatonic River (Curtiss Brook). Lake Zoar begins at the outlet of the Shepaug Dam below Lake Lillinonah at the Newtown-Southbury town border. The bacteria impaired segment (CT6000-00-05+L2_01) begins just downstream of where Gelding Brook flows into Lake Zoar in Newtown, down the lake to the Stevenson dam on the Oxford – Monroe town border. This impaired segment consists of 580.57 acres of Lake Zoar in Southbury, Newtown, Oxford, and Monroe, CT (Figures 3 and 8).

Lake Housatonic begins at the outlet of the Stevenson Dam on the Oxford-Monroe town border. The bacteria impaired segment (CT6000-00-05+L4_01) consists of 346.29 acres of the lake in Oxford, Monroe, Shelton, Seymour, and Derby, CT (Figures 3 and 9). Lake Housatonic begins at the outlet of the Stevenson Dam below Lake Zoar and continues down the lake to the Lake Housatonic Dam (Derby Dam) near Riverview Park in Shelton on the Shelton-Derby border.

Curtiss Brook begins in a forested and residential area along Shelton Avenue in Shelton, CT. The bacteria impaired segment (CT6000-73_01) consists of 0.8 miles of the brook (Figures 3 and 10). Curtiss Brook begins at the outlet of Pine Lake / Shelton Reservoir parallel to Shelton Avenue in Shelton, continues east, and flows into the Housatonic River just downstream of the Lake Housatonic Dam (Derby Dam) by Canal Street East in Shelton. The entire impaired segment of Curtiss Brook is within the City of Shelton.

Lake Zoar and Lake Housatonic have water quality classifications of B. Designated uses on these lakes include habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. These impaired segments are impaired for recreation due to elevated bacteria levels. There is a designated swimming beach on Lake Zoar in Kettletown State Park in Southbury, and a designated swimming beach on Lake Housatonic in Indian Well State Park in Shelton. As there are designated beaches on these segments, the specific recreation impairment is for designated swimming and other water contact related activities.

Curtiss Brook has a water quality classification of AA. Designated uses include existing or proposed drinking water source, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. This impaired segment is impaired for recreation due to elevated bacteria levels. As there are no designated beaches in Curtiss Brook, the specific recreation impairment is for designated swimming and other water contact related activities.

Figure 2: GIS map featuring general information of the Housatonic River watershed at the sub-regional level, showing the Housatonic River's impaired segment

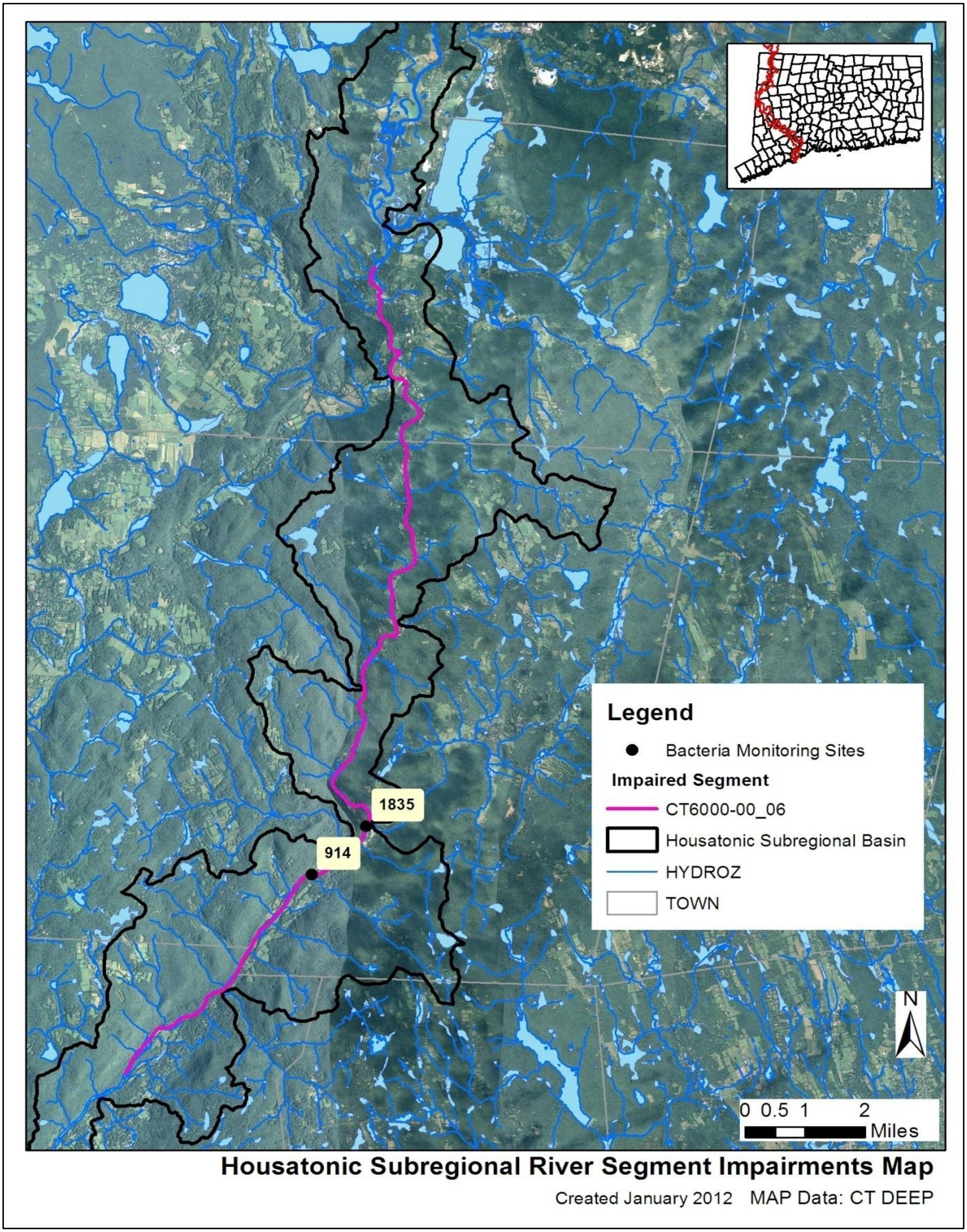
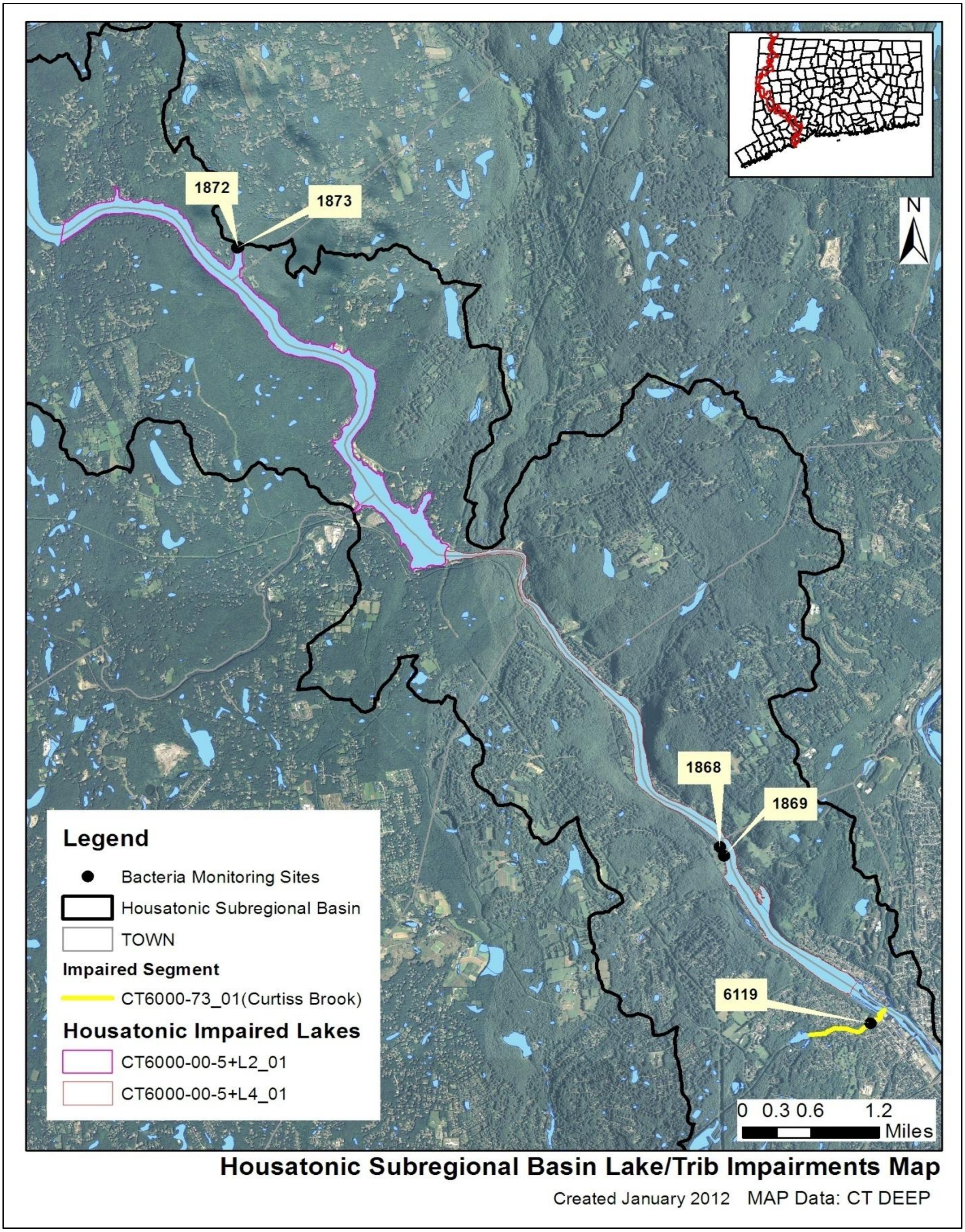


Figure 3: GIS map featuring general information of the Housatonic River watershed at the sub-regional level, showing the Lake Zoar, Lake Housatonic, and Curtiss Brook impaired segments



Land Use

Existing land use can affect the water quality of waterbodies within a watershed (USEPA, 2011c). Natural processes, such as soil infiltration of stormwater and plant uptake of water and nutrients, can occur in undeveloped portions of the watershed. As impervious surfaces (such as rooftops, roads, and sidewalks) increase within the watershed landscape from commercial, residential, and industrial development, the amount of stormwater runoff to waterbodies also increases. These waterbodies are negatively affected as increased pollutants from nutrients and bacteria from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities become entrained in this runoff. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 4, 5 and 6, the Housatonic River watershed consists of 60% forest, 25% urban area, 7% water, and 8% agriculture. The northern portions of the watershed surrounding the impaired segment of the Housatonic River in Salisbury, Canaan, Cornwall, and Kent, are dominated by forested land use. However, the area around Station 914 has agriculture near the Housatonic River's impaired segment, and the area around Station 1835 is predominantly developed. Though agricultural land use only occupy 8% of the watershed, multiple agricultural operations can be found in this portion of the watershed (Figure 5). By contrast, the southern portion of the watershed in Southbury, Newtown, Oxford, Monroe, Shelton, and Derby is more developed, particularly in Shelton and Derby. Lake Zoar has developed land near its impaired segment, while Lake Housatonic has more development and some agricultural areas close to its impaired segment. Virtually all the land surrounding Curtiss Brook's impaired segment is characterized by developed land use (Figure 6).

Figure 4: Land use within the Housatonic River watershed

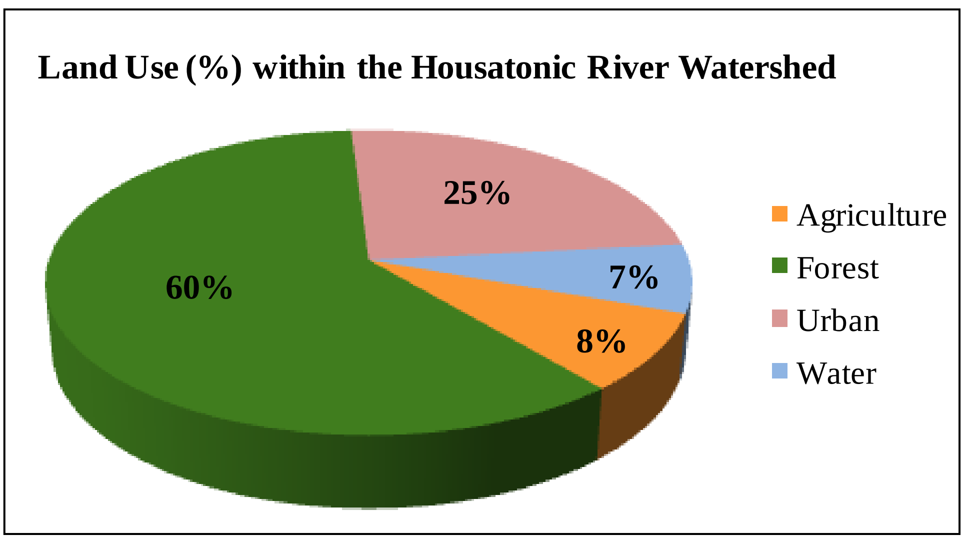


Figure 5: GIS map featuring land use for the Housatonic River watershed at the sub-regional level, showing the Housatonic River's impaired segment

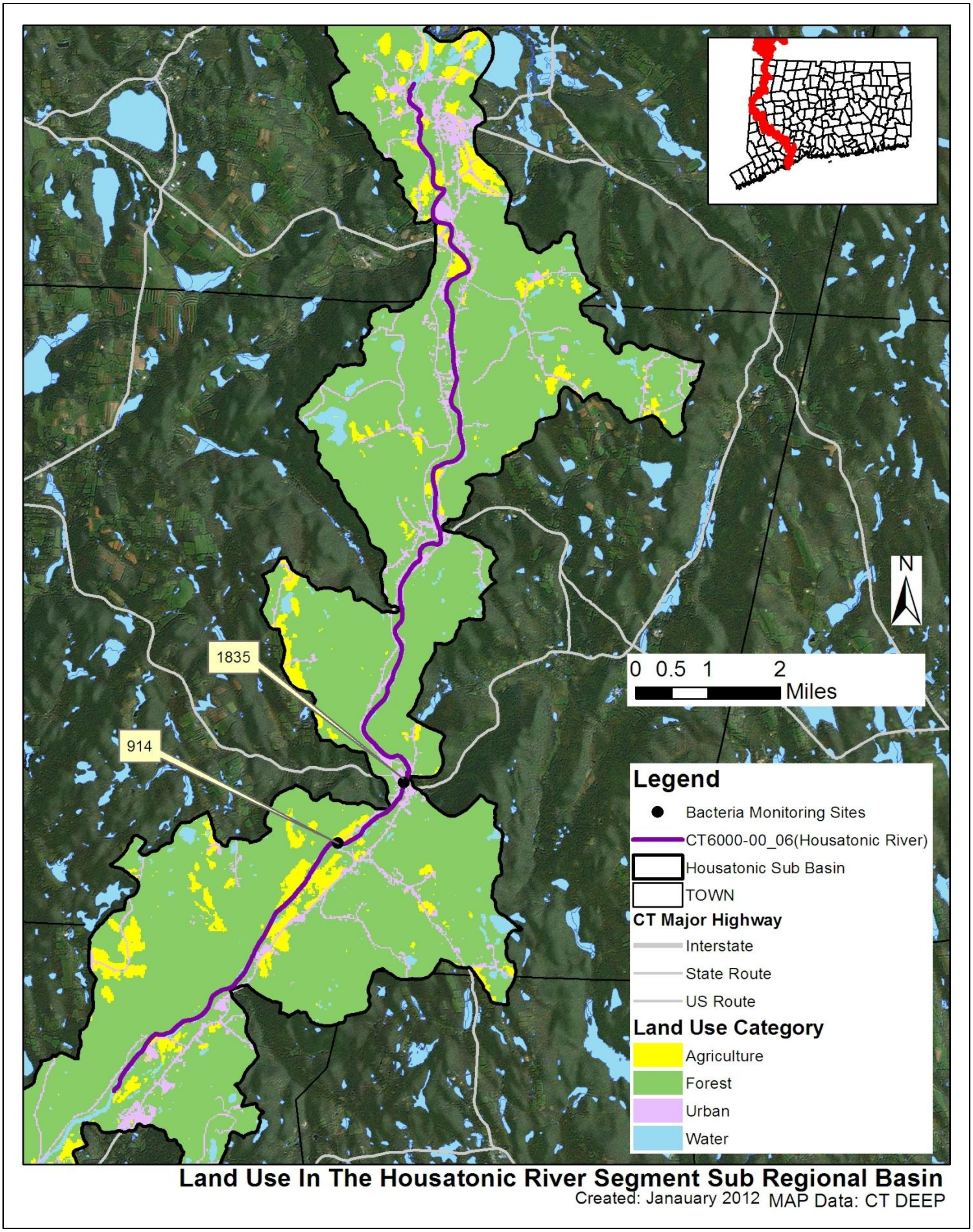
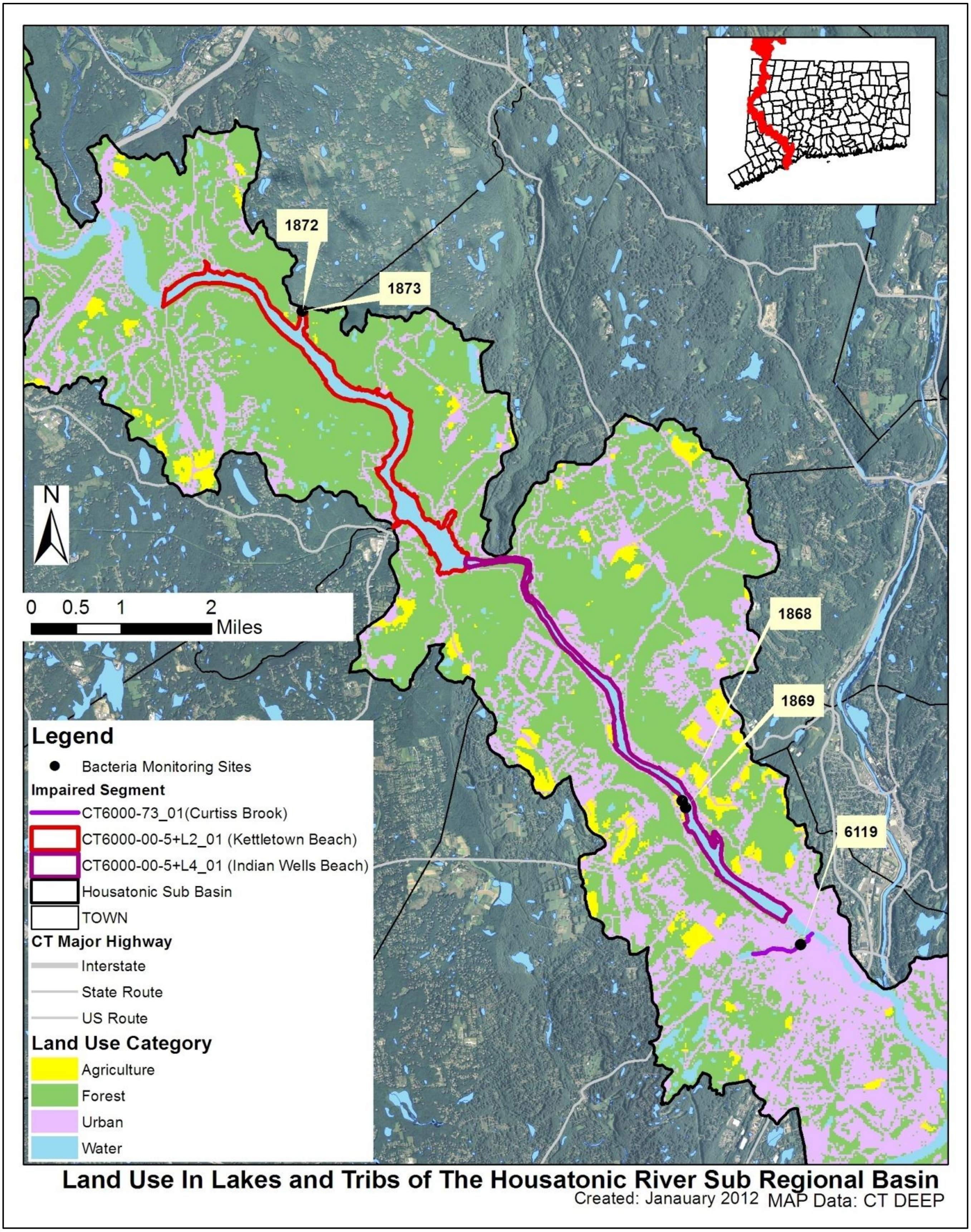


Figure 6: GIS map featuring land use for the Housatonic River watershed at the sub-regional level, showing the Lake Zoar, Lake Housatonic, and Curtiss Brook impaired segments



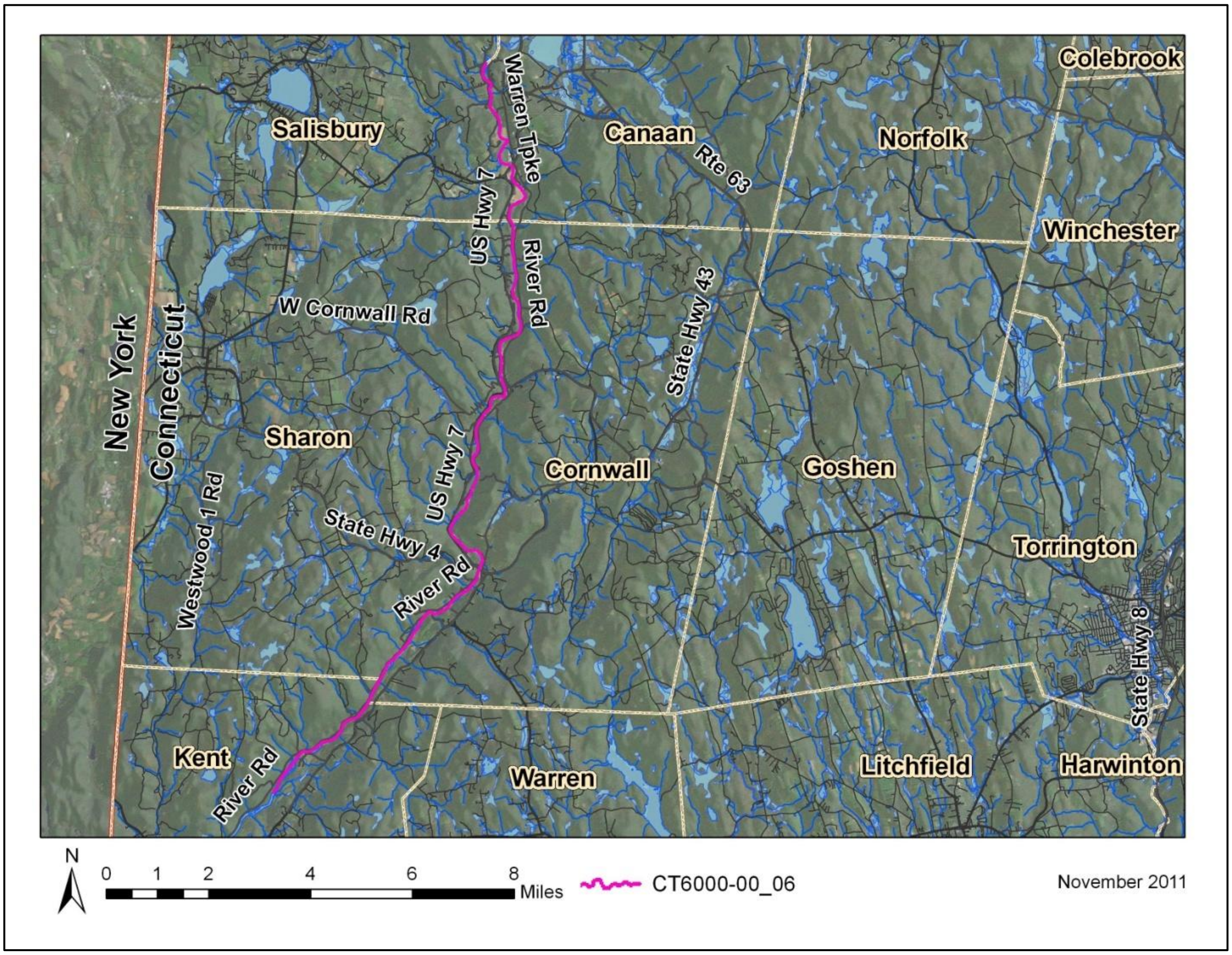
WHY IS A TMDL NEEDED?

E. coli is the indicator bacteria used for comparison with the CT State criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Table 2: Sampling station location description for the impaired segments in the Housatonic River watershed

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT6000-73_01	Curtiss Brook	6119	Route 110 crossing # 646 condos	Shelton	41.320720	-73.099380
CT6000-00-5+L4_01	Housatonic River (Lake Housatonic)	1869	Lifeguard Chair(s)	Shelton	41.343147	-73.124192
CT6000-00-5+L4_01	Housatonic River (Lake Housatonic)	1868	Lifeguard Chair(s)	Shelton	41.344319	-73.124911
CT6000-00-5+L2_01	Housatonic River (Lake Zoar)	1873	Lifeguard Chair(s)	Southbury	41.424569	-73.206911
CT6000-00-5+L2_01	Housatonic River (Lake Zoar)	1872	Lifeguard Chair(s)	Southbury	41.424664	-73.206748
CT6000-00_06	Housatonic River	914	Confluence Gunn Brook at Swifts Bridge	Cornwall	41.807233	-73.390631
CT6000-00_06	Housatonic River	1835	under Route 4 crossing	Cornwall	41.819770	-73.373075

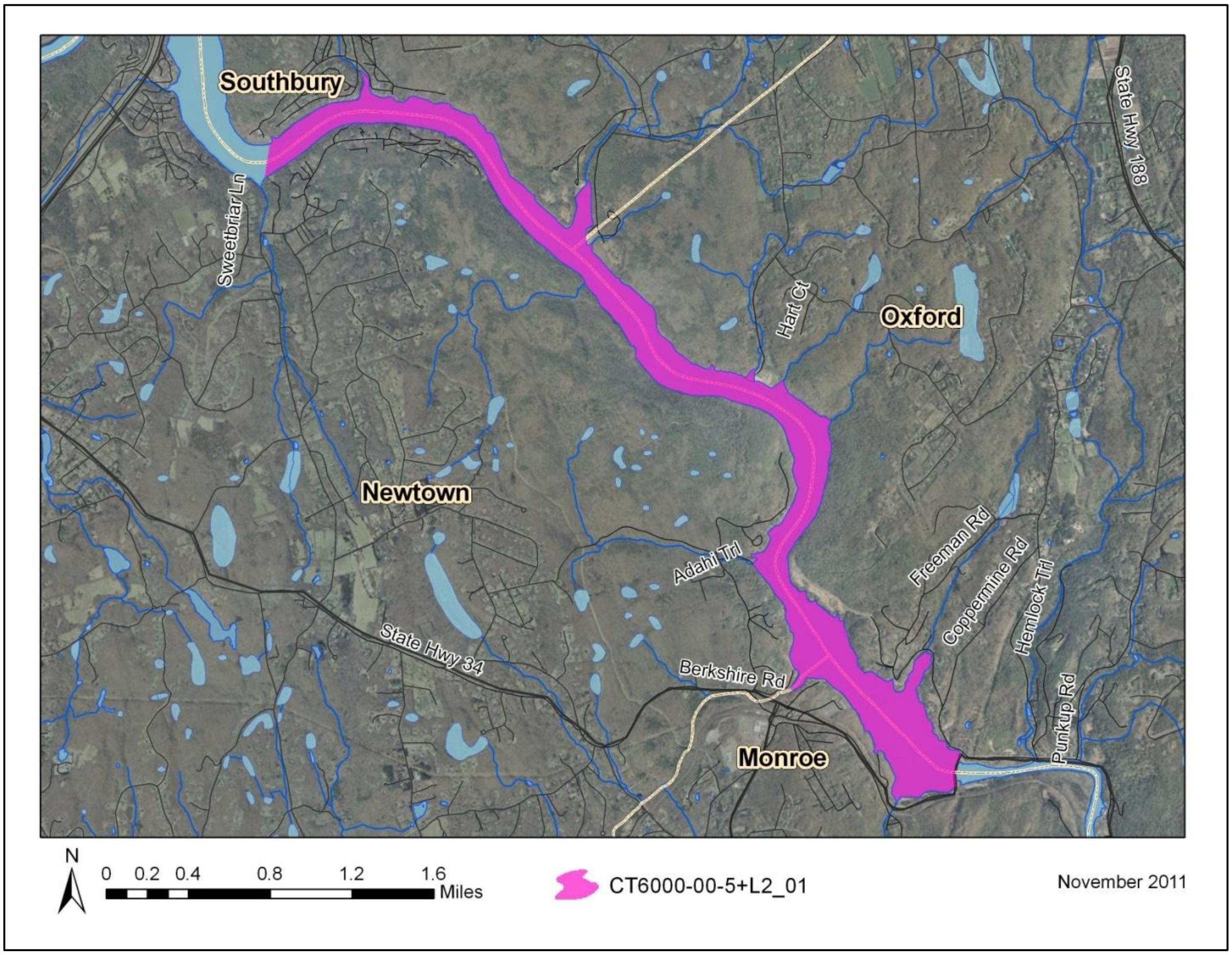
Figure 7: Aerial map of the Housatonic River



The Housatonic River (CT6000-00_06) is a Class B freshwater river (Figure 7). Its applicable designated uses are habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. Water quality analyses were conducted using data from two sampling location from 2003, 2004, and 2006-2009 (Stations 914 and 1835) (Table 2). The water quality criteria for *E. coli*, along with bacteria sampling results from 2003, 2004, and 2006-2009, are presented in Table 17. Single sample values for Station 914 did not exceed the WQS for *E. coli* in any sample year. However, single sample values for Station 1835 exceeded the WQS for *E. coli* on at least one sample date in 2006, 2007, 2008, and 2009. The annual geometric mean for Station 914 did not exceed the WQS for *E. coli* in any sample year. The annual geometric mean for Station 1835 exceeded the WQS for *E. coli* in 2008 and 2009.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days for Station 914 and Station 1835, where appropriate (Table 17). For Station 914, the geometric mean during wet and dry-weather did not exceed the WQS for *E. coli*. For Station 1835 the geometric mean during wet-weather exceeded the WQS for *E. coli.* The geometric mean during dry-weather did not exceed the WQS for *E. coli*, and the geometric mean during wet-weather was nearly three times dry-weather at Station 1835.

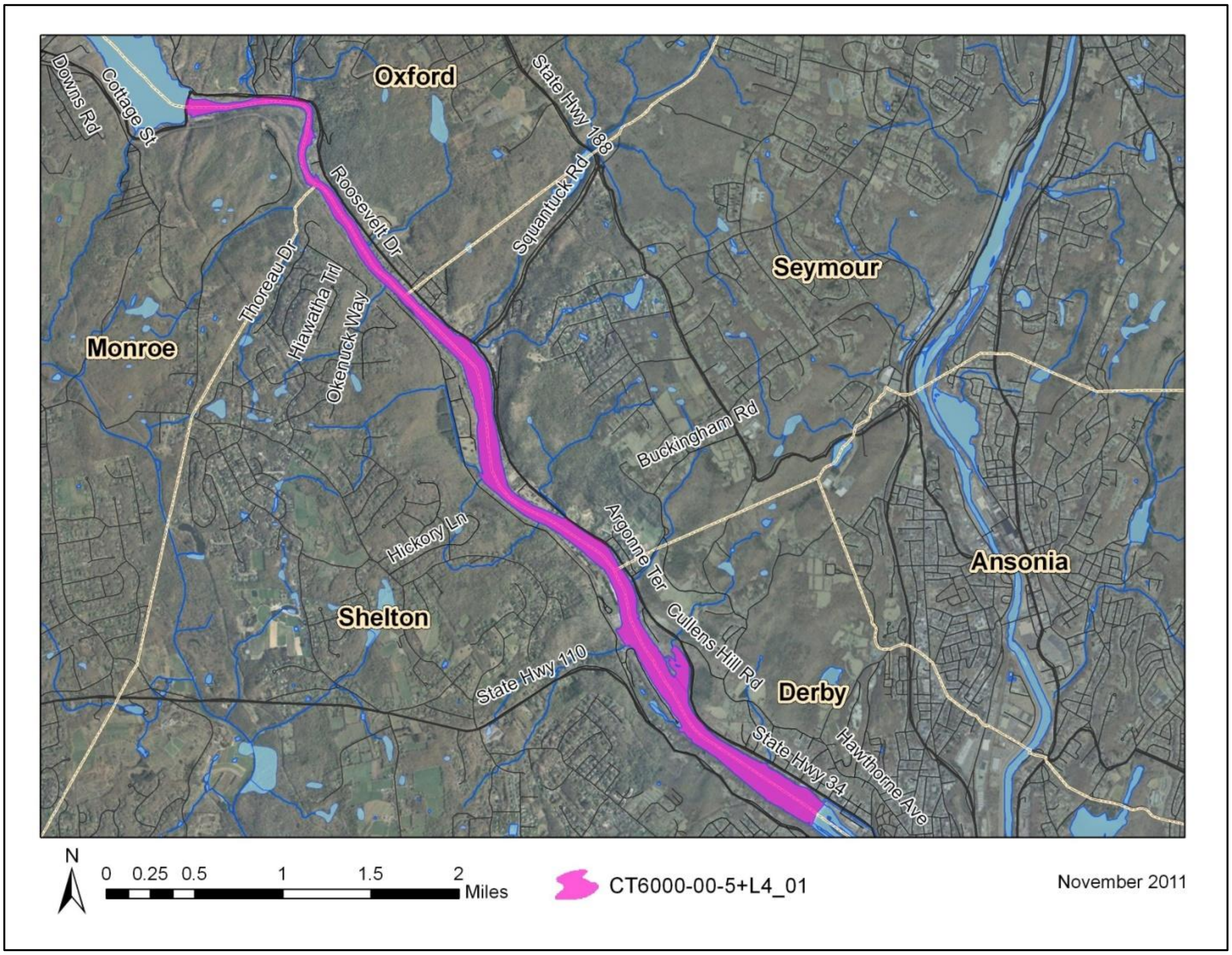
Figure 8: Aerial map of Lake Zoar



Lake Zoar (CT6000-00-05+L2_01) is a Class B freshwater lake (Figure 8). Its applicable designated uses are habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from two sampling locations from 2000, and 2002 - 2011 (Stations 1873 and 1872) (Table 2). The water quality criteria for *E. coli*, along with bacteria sampling results from 2000, and 2002 – 2011, are presented in Table 18. The annual geometric mean was calculated for both stations in all years and neither exceeded the WQS for *E. coli*. Single sample values for Station 1873 exceeded the WQS for *E. coli* at least once in all sample years, except 2002. Station 1872 had single sample exceedances in all years except 2002, 2005, 2008, and 2011.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days at Stations 1873 and 1872, where appropriate (Table 18). For Lake Zoar, the geometric mean during wet and dry-weather did not exceed the WQS for *E. coli* at either station.

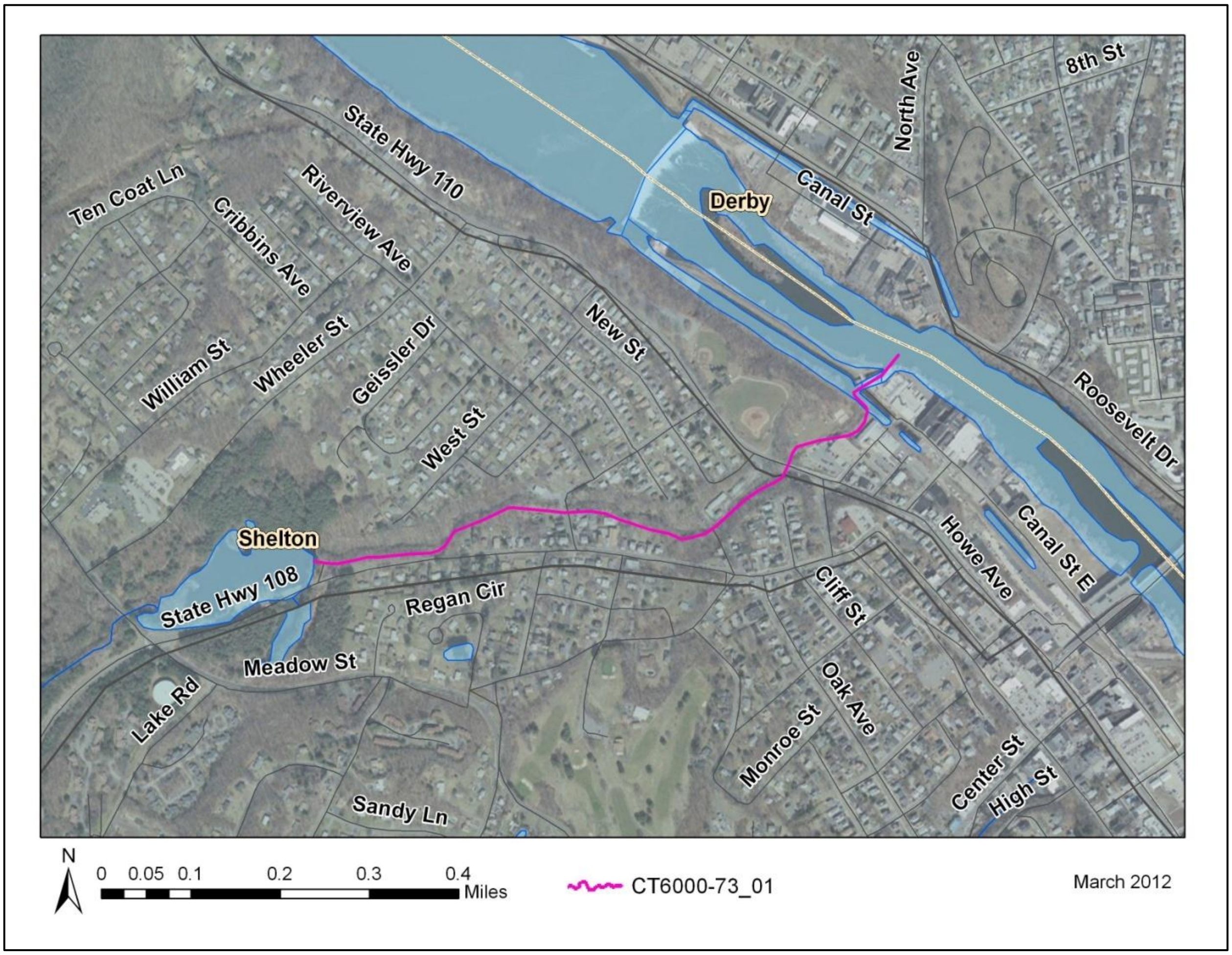
Figure 9: Aerial map of Lake Housatonic



Lake Housatonic (CT6000-00-05+L4_01) is a Class B freshwater lake (Figure 9). Its applicable designated uses are habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from two sampling locations from 2000, and 2002 - 2011 (Stations 1869 and 1868) (Table 2). The water quality criteria for *E. coli*, along with bacteria sampling results from 2000, and 2002 – 2011, are presented in Table 19. The annual geometric mean was calculated for all years and did not exceed the WQS for *E. coli* at either station in any of the sample years. Single sample values for Station 1869 exceeded the WQS for *E. coli* on at least one date in 2000, 2003, 2004, and 2007 - 2010. There were no single sample exceedances at Station 1869 in 2002, 2005, and 2011. Single sample values for Station 1868 exceeded the WQS for *E. coli* on at least one date in 2000 - 2004, 2006, and 2008-2010. There were no single sample exceedances at Station 1868 in 2005, 2007, and 2011.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days at Lake Housatonic, where appropriate (Table 19). For Lake Housatonic, geometric means during wet and dry-weather did not exceed the WQS for *E. coli* at Station 1869 or 1868.

Figure 10: Aerial map of Curtiss Brook



Curtiss Brook (CT6000-73_01) is a Class AA freshwater stream (Figure 10). Its applicable designated uses are an existing or proposed drinking water supply, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location from 2010 (Station 6119). The water quality criteria for *E. coli*, along with bacteria sampling results from 2010, are presented in Table 20. The annual geometric mean was calculated for 2010 and exceeded the WQS for *E. coli*. Single sample values for Station 6119 exceeded the WQS for *E. coli* on two sample dates in 2010.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days for Station 6119, where appropriate (Table 20). For Curtiss Brook, the geometric mean during wet-weather exceeded the WQS for *E. coli*, and was nearly three times the value of the dry-weather.

Due to the elevated bacteria measurements presented in Tables 17 – 20, these four impaired segments did not meet CT's bacteria WQS, were identified as impaired, and were placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the watershed based on land use (Figures 4, 5, and 6) and a collection of local information for the impaired waterbody is presented in Table 3 and Figures 11 and 12. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segments. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not suggest that there are no potential issues on this segment, but indicates a lack of current data to evaluate the segment as part of the assessment process. For some segments, there are data from permitted sources, and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 3: Potential bacteria sources in the Housatonic River watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Housatonic River CT6000-00_06	x			x	x	x	x	
Lake Zoar CT6000-00-05+L2_01	x	x		x		x	x	
Lake Housatonic CT6000-00-05+L4_01	x	x		x	x	x	x	
Curtiss Brook CT6000-73_01	x	x				x	x	

Figure 11: Potential sources in the Housatonic River watershed at the sub-regional level, showing the Housatonic River's impaired segment

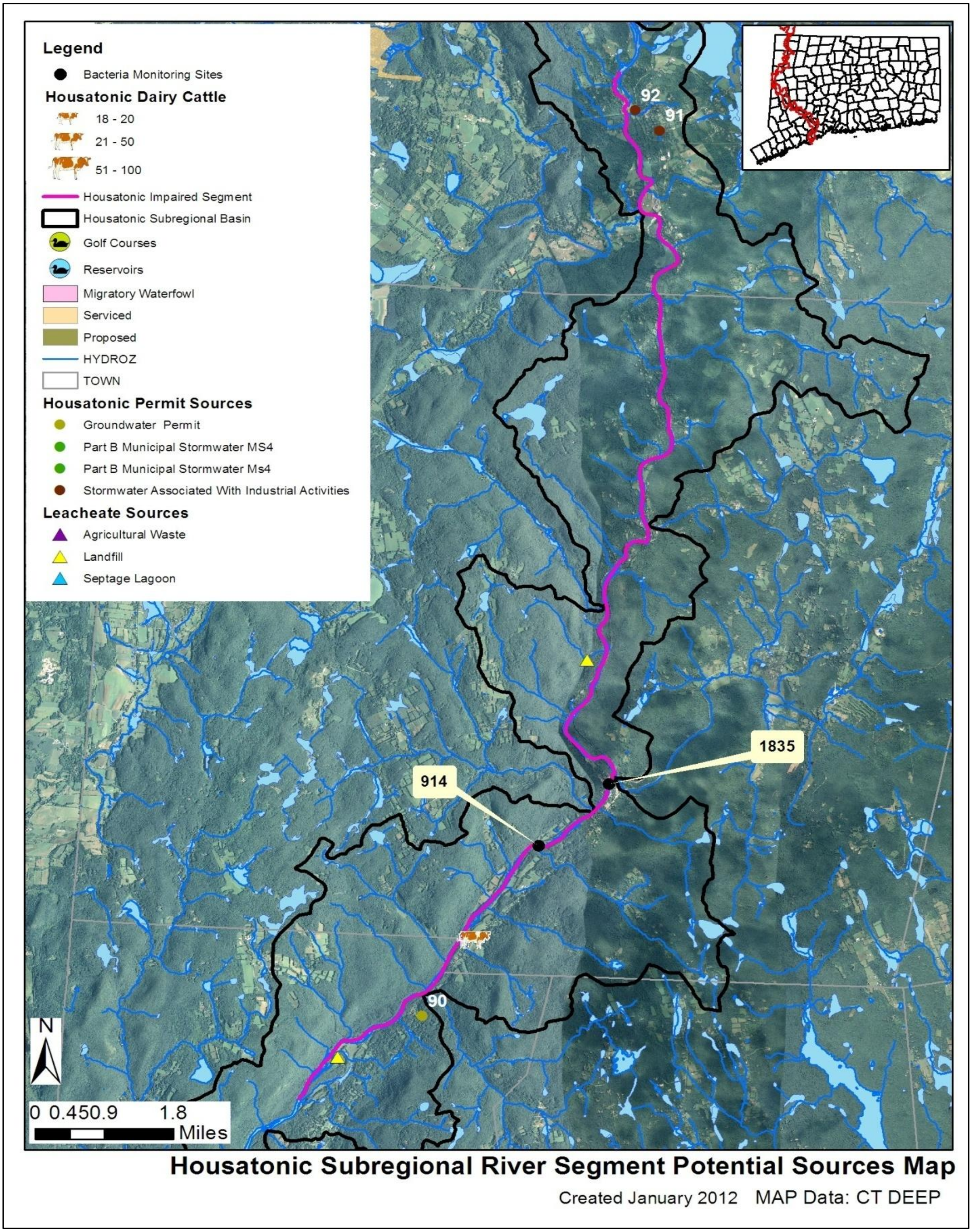
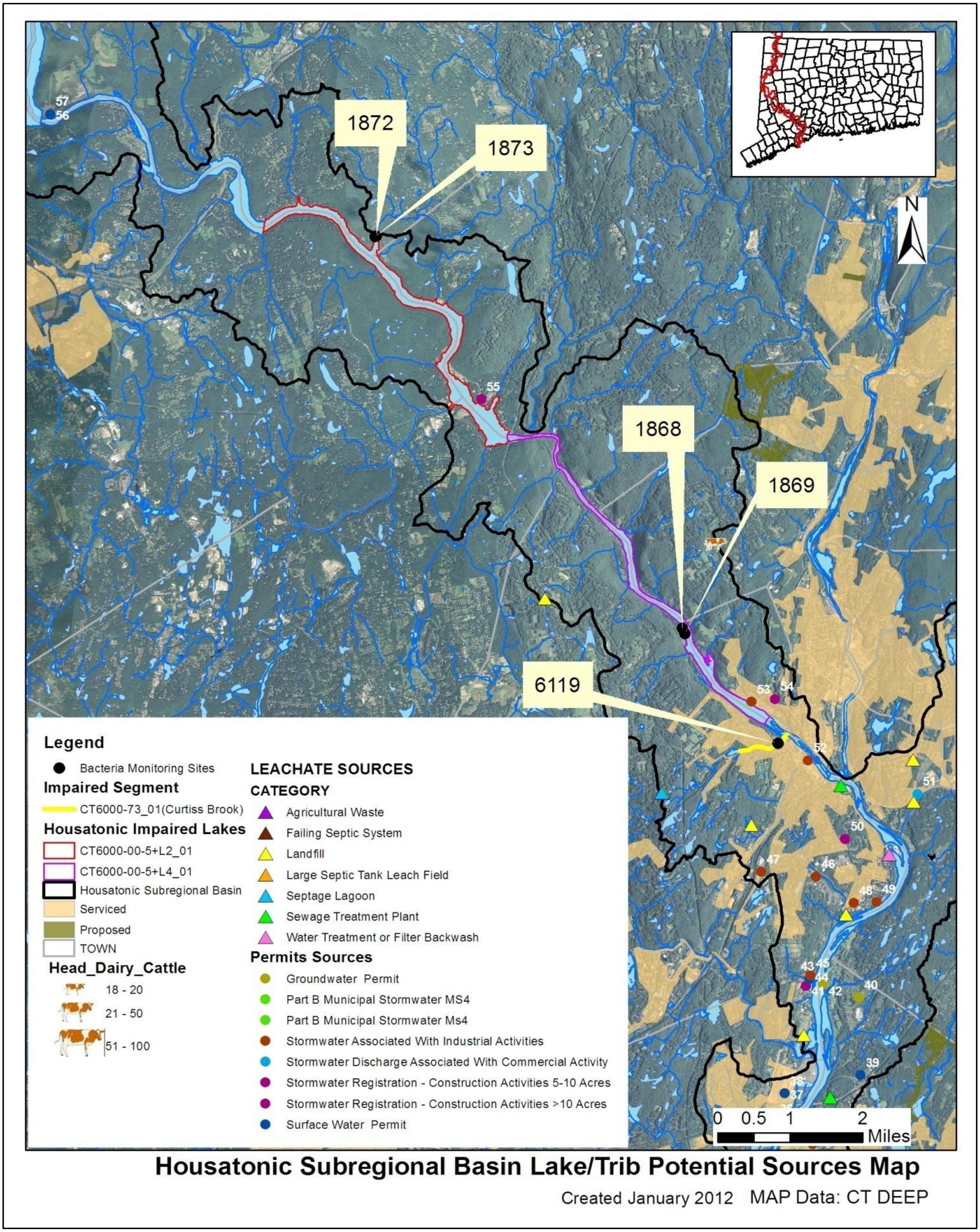


Figure 12: Potential sources in the Housatonic River watershed at the sub-regional level, showing the Lake Zoar, Lake Housatonic, and Curtiss Brook impaired segments



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 5. Additional investigation and monitoring could reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type. When available, bacteria data results from these permitted sources are listed in Tables 6 - 8.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	6
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	3
GSI	Stormwater Associated with Industrial Activity	28
GSM	Part B Municipal Stormwater MS4	7
GSN	Stormwater Registration – Construction	8
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	7

Permitted Sources

As shown in Table 5, there are many permitted discharges in the Housatonic River watershed. Bacteria data from 2001 – 2003 from many of these industrial permitted facilities are included in Table 6. Though this data cannot be compared to a water quality standard as there is no recreation standard for fecal coliform bacteria, multiple samples were high with readings exceeding 1,000 colonies/100mL. While New Milford is not located along any of the impaired segments, it is located on the Housatonic River downstream from Segment 6, but upstream of Lake Zoar and Lake Housatonic. The industrial permitted facilities in New Milford, including the New Milford Public Works (GSI001240), FIS-North America, Inc. (GSI001336), Schneider National Carriers (GSI000141), and Kimberly-Clark Corp (GSI000746), all had readings over 1,000 colonies/100 mL. While not directly discharging to Lake Zoar or Lake Housatonic, these readings indicate that permitted facilities in New Milford are contributing bacteria to the Housatonic River upstream of these segments. There is one industrial permitted facility that does discharge directly to Lake Housatonic in Shelton. Auto Swage Products (GSI000625) had readings over 30,000 colonies/100 mL.

Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Housatonic River watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Bridgewater	Bridgewater Commons Association, Inc.	UI0000035	Groundwater Permit	Bridgewater Commons	65
Brookfield	Lake Lillinonah Shores Condominium Association No. 2, Inc.	UI0000033	Groundwater Permit	Septicwtr Lake Lillinonah 2	62
Brookfield	Lake Lillinonah Shores Condominium Association No. 2, Inc.	UI0000033	Groundwater Permit	Lake Lillinonah Shores Condominium Association No. 2, Inc.	64
Brookfield	Lake Lillinonah Shores Condominium Association No. 1, Inc.	UI0000134	Groundwater Permit	Lake Lillinonah Shores Condos	63
Brookfield	Town Of Brookfield	GSI000757	Stormwater Associated With Industrial Activities	Brookfield Highway Garage	59
Brookfield	State Of Connecticut Department Of Transportation	GSN001647	Stormwater Registration - Construction Activities >10 Acres	State Project No. 18-113	60
Brookfield	State Of Connecticut Department Of Transportation	GSN001786	Stormwater Registration - Construction Activities 5-10 Acres	State Project # 18-118	61
Derby	City Of Derby	GSM000114	Part B Municipal Stormwater Ms4	City of Derby	NA
Derby	Whitney’s Marina	GSI002287	Stormwater Associated With Industrial Activities	412 Roosevelt Dr	52
Derby	Lowe’s Home Centers Inc	GSC000306	Stormwater Discharge Associated With Commercial Activity	Lowe’s Home Center, Inc.	50
Derby	City Of Derby	GSN001859	Stormwater Registration - Construction Activities 5-10 Acres	Derby Middle School	53
Devon	Nrg Devon Operations Inc.	CT0003107	Surface Water Permit	Nrg Devon Operations, Inc.	16
Falls Village	Town Of North Canaan	GSI001499	Stormwater Associated With Industrial Activities	Canaan Highway Department	91
Falls Village	Firstlight Hydro Generating Company, Ne Hydro Generating Co	GSI001940	Stormwater Associated With Industrial Activities	Falls Village Hydroelectric Station	92

Table 5: Permitted facilities within the Housatonic River watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Gaylordsville	Firstlight Hydro Generating Company, Ne Hydro Generating Co	GSI001939	Stormwater Associated With Industrial Activities	Bull's Bridge Hydroelectric Station	85
Kent	Brookwoods Ii Association, Inc.	UI0000142	Groundwater Permit	Brookwood Ii	90
Kent	Town Of Kent	UI0000311	Groundwater Permit	Kent Wpca	86
Kent	Town Of Kent	UI0000311	Groundwater Permit	Kent Wpcf	87
Kent	Town Of Kent	GSI000120	Stormwater Associated With Industrial Activities	38 Maple Street	89
Kent	State Of Connecticut Department Of Transportation	GSI001824	Stormwater Associated With Industrial Activities	Kent Satellite Salt Storage Facility	88
Monroe	Town of Monroe	GSM000013	Part B Municipal Stormwater Ms4	Town of Monroe	N/A
New Milford	State Of Connecticut Department Of Transportation	GSI000045	Stormwater Associated With Industrial Activities	Ct Dot/New Milford Maintenance Fac	79
New Milford	Kimberly-Clark Corporation	GSI000745	Stormwater Associated With Industrial Activities	Kimberly-Clark Corporation	71
New Milford	Kimberly-Clark Corporation	GSI000746	Stormwater Associated With Industrial Activities	Kimberly-Clark Corporation	70
New Milford	Neeltran, Inc.	GSI000754	Stormwater Associated With Industrial Activities	Neeltran Inc	69
New Milford	Ach Food Companies, Inc.	GSI000989	Stormwater Associated With Industrial Activities	Stratas Foods	67
New Milford	Town Of New Milford	GSI001240	Stormwater Associated With Industrial Activities	New Milford Public Works	78
New Milford	O & G Industries, Inc.	GSI001933	Stormwater Associated With Industrial Activities	New Milford Quarry	82
New Milford	Firstlight Hydro Generating Company, Ne Hydro Generating Co	GSI001941	Stormwater Associated With Industrial Activities	Rocky River Hydroelectric Station	80
New Milford	Town Of New Milford	GSI001952	Stormwater Associated With Industrial Activities	New Milford Wpcf	75
New Milford	The Garick Corporation	GSI002026	Stormwater Associated With Industrial Activities	New Milford Ct Farms Compost	83

Table 5: Permitted facilities within the Housatonic River watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
New Milford	Bill's Garage Inc	GSI002186	Stormwater Associated With Industrial Activities	A & B Auto Salvage, Inc.	84
New Milford	Stratas Foods Llc	GSI002224	Stormwater Associated With Industrial Activities	Stratas Foods	68
New Milford	Home Depot U. S. A., Inc.	GSC000332	Stormwater Discharge Associated With Commercial Activity	Home Depot, The #4878	66
New Milford	Urstadt Biddle Properties Inc.	GSC000369	Stormwater Discharge Associated With Commercial Activity	Veteran's Plaza	77
New Milford	Cr Meyer & Sons Company	GSN001701	Stormwater Registration - Construction Activities 5-10 Acres	Kimberly-Clark Corporation	72
New Milford	David And Dana Edelman Llc	GSN001803	Stormwater Registration - Construction Activities 5-10 Acres	Edelman Metal Works	74
New Milford	Kimberly-Clark Corporation	CT0003212	Surface Water Permit	Kimberly-Clark Corporation	73
New Milford	The Connecticut Light And Power Company, Firstlight Hydro Generating Company	CT0030287	Surface Water Permit	Rocky River Hydroelectric Station	81
New Milford	Town Of New Milford	CT0100391	Surface Water Permit	New Milford Wpcf	76
Newtown	Town of Newtown	GSM000048	Part B Municipal Stormwater Ms4	Town of Newtown	N/A
North Canaan	Town Of North Canaan	GSI001294	Stormwater Associated With Industrial Activities	New Canaan Transfer Station	93
Oxford	Town of Oxford	GSM000008	Part B Municipal Stormwater Ms4	Town of Oxford	N/A
Oxford	Connecticut Commercial Investors, Llc	GSN002225	Stormwater Registration - Construction Activities >10 Acres	Fiddlehead Subdivision	54
Seymour	Town of Seymour	GSM000009	Part B Municipal Stormwater Ms4	Town of Seymour	N/A
Shelton	City of Shelton	GSM000025	Part B Municipal Stormwater Ms4	City of Shelton	N/A
Shelton	Chromium Process Co.	GSI000410	Stormwater Associated With Industrial Activities	Chromium Process Company, The	51

Table 5: Permitted facilities within the Housatonic River watershed (continued)

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Shelton	Auto Swage Products Inc	GSI000625	Stormwater Associated With Industrial Activities	Auto Swage Products, Inc.	42
Shelton	Sikorsky Aircraft Corporation	GSI000769	Stormwater Associated With Industrial Activities	Sikorsky Aircraft Shelton Iii	48
Shelton	Mica Corporation	GSI001219	Stormwater Associated With Industrial Activities	Mica Corporation	47
Shelton	Latex Foam International, Llc	GSI001504	Stormwater Associated With Industrial Activities	Latex International, Llc	45
Shelton	Beacon Point Marine Inc	GSI002103	Stormwater Associated With Industrial Activities	Beacon Point Marine	44
Shelton	River’s End Marina Inc.	GSI002251	Stormwater Associated With Industrial Activities	River’s End Marina	46
Shelton	Rgr Shelton, Llc	GSN001828	Stormwater Registration - Construction Activities >10 Acres	Crescent Village	40
Shelton	252 Grove Street Llc	GSN002199	Stormwater Registration - Construction Activities 5-10 Acres	Scenic Grove Estates	49
Shelton	Auto Swage Products Inc	CT0020826	Surface Water Permit	Auto Swage Products, Inc.	43
Southbury	Town of Southbury	GSM000028	Part B Municipal Stormwater Ms4	Town of Southbury	N/A
Southbury	Firstlight Hydro Generating Company, Ne Hydro Generating Co	GSI001944	Stormwater Associated With Industrial Activities	Shepaug Hydroelectric Station	55
Southbury	Firstlight Hydro Generating Company	CT0030228	Surface Water Permit	Shepaug Hydroelectric Station	56

Table 6: Industrial permits in the Housatonic River watershed and available fecal coliform data (colonies/100mL). The result cannot be compared to the water quality standard as there is no recreation standard for fecal coliform.

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Canaan	Town of Canaan	GSI001499	Wetlands, Housatonic River	DPW Garage-OF-1	09/16/02	800
Canaan	Town of Canaan	GSI001499	Wetlands, Housatonic River	DPW Garage-OF-2	09/16/02	500
Canaan	Town of Canaan	GSI001502	Wetlands, Housatonic River	Transfer Station-OF-1	09/16/02	400
Canaan	Town of Canaan	GSI001502	Wetlands, Housatonic River	Transfer Station-OF-2	09/16/02	100
Canaan	Northeast Generation Company	GSI001279	Housatonic River	Falls Village 001	07/26/01	>600
New Milford	New Milford Public Works	GSI001240	Housatonic River	middle	09/14/01	2,200
New Milford	New Milford Public Works	GSI001240	Housatonic River	south	09/14/01	4,400
New Milford	FIS-North America	GSI001336	Housatonic River	OF 1	09/15/02	>600
New Milford	FIS-North America	GSI001336	Housatonic River	OF 17	09/15/02	>600
New Milford	FIS-North America	GSI001336	Housatonic River	OF 2	09/15/02	370
New Milford	FIS-North America	GSI001336	Housatonic River	OF 3	09/15/02	>600
New Milford	FIS-North America	GSI001336	Housatonic River	OF 4	09/15/02	>600
New Milford	FIS-North America, Inc.	GSI001336	Housatonic River	Outfall #1	06/02/01	18,000
New Milford	FIS-North America, Inc.	GSI001336	Housatonic River	Outfall #17	06/02/01	110,000
New Milford	FIS-North America, Inc.	GSI001336	Housatonic River	Outfall #2	06/02/01	1,000
New Milford	FIS-North America, Inc.	GSI001336	Housatonic River	Outfall #3	06/02/01	5,000
New Milford	FIS-North America, Inc.	GSI001336	Housatonic River	Outfall #4	06/02/01	13,000
New Milford	Schneider National Carriers	GSI000141	Housatonic River	001	05/24/01	2,200
New Milford	Schneider National Carriers	GSI000141	Housatonic River	001	11/06/02	100

Table 6: Industrial permits in the Housatonic River watershed and available fecal coliform data (colonies/100mL). The result cannot be compared to the water quality standard as there is no recreation standard for fecal coliform. (continued)

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
New Milford	Kimberly-Clark Corp	GSI000746	Housatonic River	D001-ETP	09/14/01	650
New Milford	Kimberly-Clark Corp	GSI000746	Housatonic River	D003 SD	09/14/01	425
New Milford	Kimberly-Clark Corp	GSI000746	Housatonic River	D003 SD	08/29/02	350
New Milford	Kimberly-Clark Corp	GSI000746	Housatonic River	S mill pkng lot-004	09/14/01	2,600
New Milford	Kimberly-Clark Corp	GSI000746	Housatonic River	S mill pkng lot-004	08/29/02	530
New Milford	Neeltran	GSI000754	Housatonic River	Storm Drain	08/29/02	270
New Milford	Neeltran	GSI000754	Housatonic River		09/14/01	750
New Milford	A.C. Humko	GSI000989	Housatonic River	DSN 001	04/22/02	100
New Milford	ACH Food Co	GSI000989	Housatonic River	DSN 001	09/15/02	150
New Milford	A.C. Humko	GSI000989	Housatonic River	DSN 002	04/22/02	100
New Milford	ACH Food Co	GSI000989	Housatonic River	DSN 002	09/15/02	80
Shelton	Mica Corp	GSI001219	Housatonic River	CB-1	11/15/01	100
Shelton	Mica Corp	GSI001219	Housatonic River	CB-1	09/26/02	500
Shelton	Latex Foam International	GSI001504	Housatonic River	1 (LF-1)	04/22/03	10
Shelton	Latex Foam International	GSI001504	Housatonic River	2(LF-2)	04/22/03	10
Shelton	Latex Foam International	GSI001504	Housatonic River	LF-1	09/26/02	100
Shelton	Latex Foam International	GSI001504	Housatonic River	LF-2	09/26/02	100
Shelton	Emhart Fasteners Technologies	GSI000198	Housatonic River	Outfall 001	09/20/01	50
Shelton	Emhart Fasteners Technologies	GSI000198	Housatonic River	Outfall 002	09/20/01	250
Shelton	Ascom Hasler Mailing Systems	GSI000312	Housatonic River	roof drain	08/20/01	100
Shelton	Auto Swage Products	GSI000625	Housatonic River	DSN 006	11/15/01	10

Table 6: Industrial permits in the Housatonic River watershed and available fecal coliform data (colonies/100mL). The result cannot be compared to the water quality standard as there is no recreation standard for fecal coliform. (continued)

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Shelton	Auto Swage Products	GSI000625	Housatonic River	DSN 007	11/15/01	100
Shelton	Auto Swage Products	GSI000625	Housatonic River	DSN006	08/20/02	31,300
Shelton	Auto Swage Products	GSI000625	Housatonic River	DSN007	08/20/02	130
Shelton	City of Shelton	GSI000999	Housatonic River	last CB	07/26/01	280

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segments in the Housatonic River watershed are located within the Towns of Derby, Shelton, Seymour, Oxford, Monroe, Newtown, and Southbury, CT (Figures 13 and 14). These municipalities have designated urban areas, as defined by the U.S. Census Bureau, and are required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (DEEP) (Figures 13 and 14). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Multiple MS4 outfalls that discharge to one of the impaired segments have been sampled for *E. coli* bacteria in the watershed (Table 7). In Derby, three MS4 outfalls were sampled from 2006 – 2008 for a total of 10 samples. Of these outfalls, all three exceeded the single sample water quality standard of 410 colonies/100 mL on at least one sample date. In all, six out of 10 (60%) of the samples exceeded the single sample water quality standard of 410 colonies/100mL. Several of the samples taken from the Derby MS4 outfalls were extremely high with readings of 75,000 colonies/100 mL. In Newtown, three MS4 outfalls were sampled in 2004 and 2006. None of the outfalls exceeded the single sample water quality standard for *E. coli* bacteria.

Figure 13: MS4 areas of the Housatonic River watershed, showing the Housatonic River's impaired segment

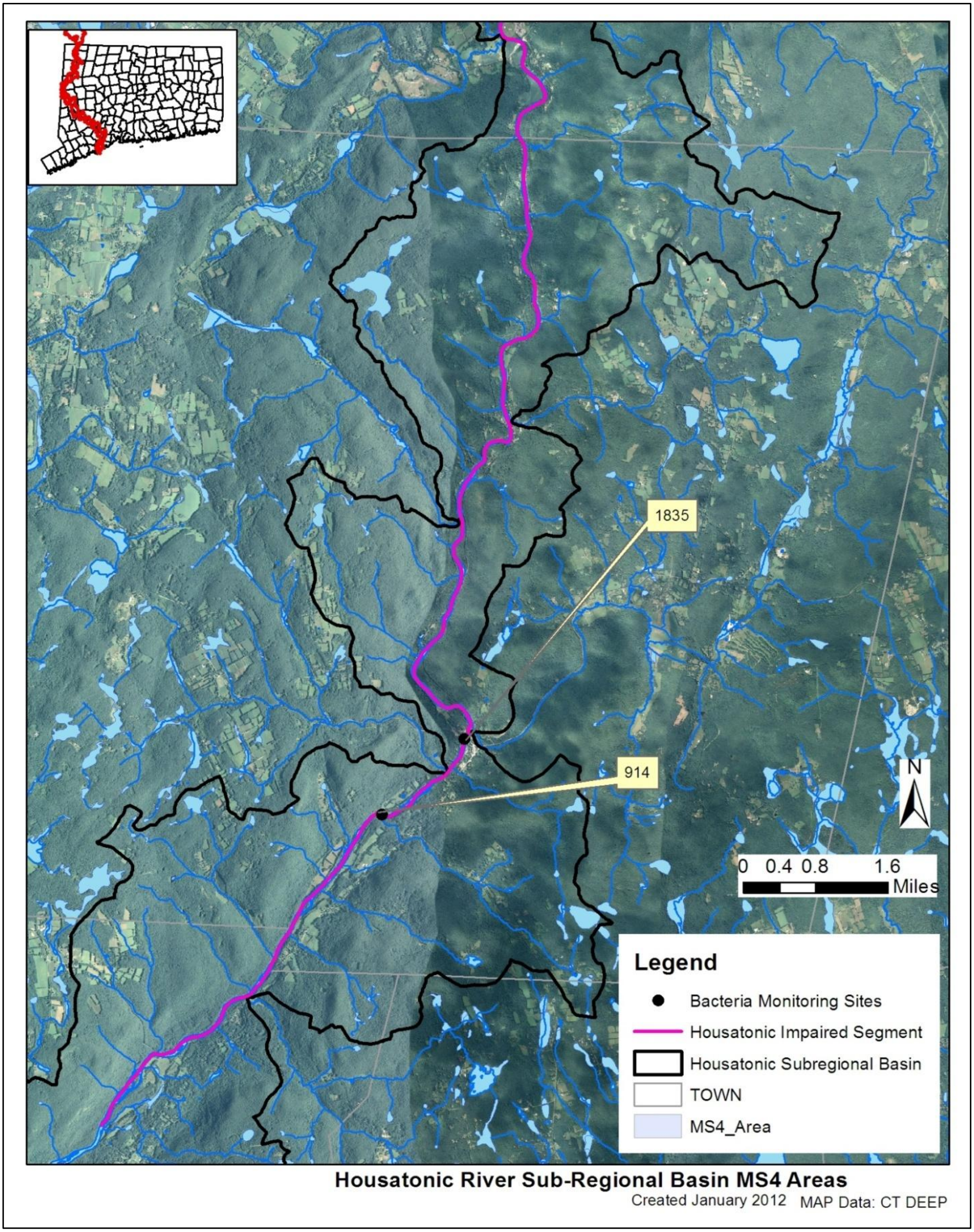


Figure 14: MS4 areas of the Housatonic River watershed, showing the Lake Zoar, Lake Housatonic, and Curtiss Brook impaired segments

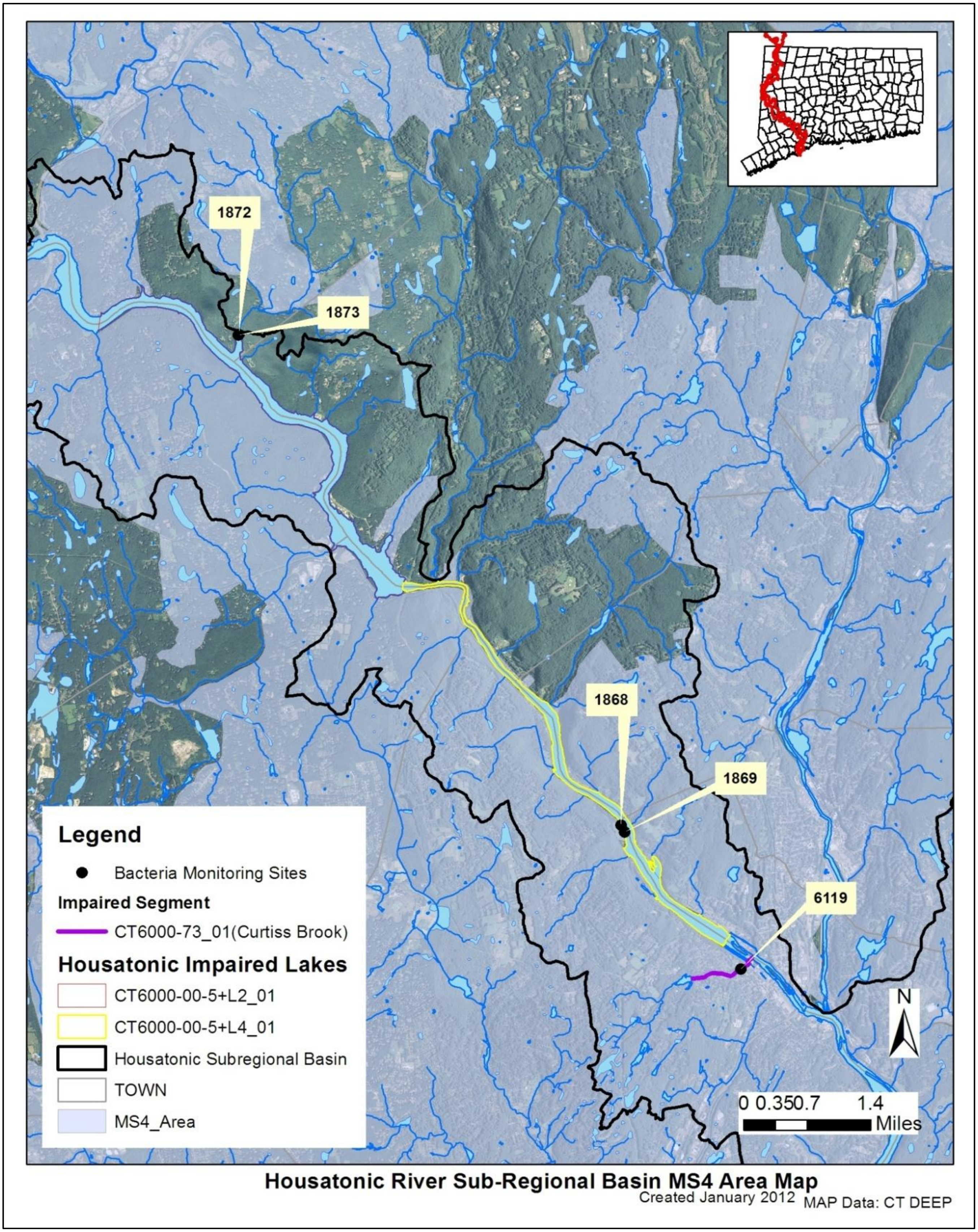


Table 7: List of MS4 sample locations and *E. coli* (colonies/100 mL) results in the Housatonic River watershed

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
Derby	C1 41 19' 10.18" N , 73 5' 25.32" W	Commercial	Housatonic River	12/13/06	1,400
Derby	C1 41 19' 10.18" N , 73 5' 25.32" W	Commercial	Housatonic River	06/20/07	7,500
Derby	C1 41 19' 10.18" N , 73 5' 25.32" W	Commercial	Housatonic River	03/19/08	1,000
Derby	C1 41 19' 10.18" N , 73 5' 25.32" W	Commercial	Housatonic River	05/16/08	75,000
Derby	I1 41 19' 32.14" N, 73 6' 1.94" W	Industrial	Housatonic River	12/13/06	200
Derby	I1 41 19' 32.14" N, 73 6' 1.94" W	Industrial	Housatonic River	05/16/08	75,000
Derby	I2 41 18' 46.91"N 73 4' 41.67 W	Industrial	Housatonic River	12/13/06	100
Derby	I2 41 18' 46.91"N 73 4' 41.67 W	Industrial	Housatonic River	06/20/07	150
Derby	I2 41 18' 46.91"N 73 4' 41.67 W	Industrial	Housatonic River	03/19/08	60
Derby	I2 41 18' 46.91"N 73 4' 41.67 W	Industrial	Housatonic River	05/16/08	5,000
Newtown	Riverside Rd-BIG Culvert Near HO #48 BC#140057D	Residential	Housatonic River	12/07/04	40
Newtown	Walnut Tree Hill across from rivers edge BC#140057F	Residential	Housatonic River	12/07/04	10
Newtown	Walnut Tree Hill BC#142304C	Residential	Housatonic River	11/08/06	280
Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)					

Publicly Owned Treatment Works

Figure 12 shows two publicly owned treatment works (POTWs), or wastewater treatment plants, in the southern portion of the Housatonic River watershed. The Derby Water Pollution Control Facility (WPCF) is located in the southern portion of the watershed and discharges to the Housatonic River, downstream of the impaired segment. The Shelton WPCF is also located in the southern portion of the watershed and discharges to the Housatonic River, downstream of the impaired segment. Bacteria data from the discharges of these plants are included in Table 8. The plants did not exceed their permit limits on any dates sampled.

Table 8: Wastewater treatment plant Fecal Coliform (colonies/100 mL) data discharging to the Saugatuck River

Town	Permitee	Permit Number	Receiving Water	Date	30-Day Geometric Mean	7-Day Geometric Mean
Derby	Derby WPCF	CT0100161	Housatonic River	05/31/2009	41	52
Derby	Derby WPCF	CT0100161	Housatonic River	06/30/2009	18	23
Derby	Derby WPCF	CT0100161	Housatonic River	07/31/2009	33	66
Derby	Derby WPCF	CT0100161	Housatonic River	08/31/2009	7	55
Derby	Derby WPCF	CT0100161	Housatonic River	09/30/2009	23	23
Derby	Derby WPCF	CT0100161	Housatonic River	05/31/2010	10	12
Derby	Derby WPCF	CT0100161	Housatonic River	06/30/2010	31	35
Derby	Derby WPCF	CT0100161	Housatonic River	07/31/2010	34	32
Derby	Derby WPCF	CT0100161	Housatonic River	08/31/2010	64	66
Derby	Derby WPCF	CT0100161	Housatonic River	09/30/2010	20	45
Derby	Derby WPCF	CT0100161	Housatonic River	05/31/2011	14	15
Derby	Derby WPCF	CT0100161	Housatonic River	06/30/2011	13	15
Derby	Derby WPCF	CT0100161	Housatonic River	07/31/2011	22	32
Derby	Derby WPCF	CT0100161	Housatonic River	08/31/2011	29	41
Derby	Derby WPCF	CT0100161	Housatonic River	09/30/2011	25	28
Shelton	Shelton WPCF	CT0100714	Housatonic River	05/31/2009	22	30
Shelton	Shelton WPCF	CT0100715	Housatonic River	06/30/2009	15	22
Shelton	Shelton WPCF	CT0100716	Housatonic River	07/31/2009	18	25
Shelton	Shelton WPCF	CT0100717	Housatonic River	08/31/2009	13	15
Shelton	Shelton WPCF	CT0100718	Housatonic River	09/30/2009	9	11
Shelton	Shelton WPCF	CT0100719	Housatonic River	05/31/2010	13	15
Shelton	Shelton WPCF	CT0100720	Housatonic River	06/30/2010	13	15
Shelton	Shelton WPCF	CT0100721	Housatonic River	07/31/2010	11	12
Shelton	Shelton WPCF	CT0100722	Housatonic River	08/31/2010	13	19
Shelton	Shelton WPCF	CT0100723	Housatonic River	09/30/2010	13	15
Shelton	Shelton WPCF	CT0100723	Housatonic River	5/31/2011	3	8
Shelton	Shelton WPCF	CT0100723	Housatonic River	6/30/2011	6	17
Shelton	Shelton WPCF	CT0100723	Housatonic River	7/31/2011	9	17
Shelton	Shelton WPCF	CT0100723	Housatonic River	8/31/2011	6	18
Shelton	Shelton WPCF	CT0100723	Housatonic River	9/30/2011	4	18
30-Day Geometric Mean Permit Limit = 200 colonies/100 mL						
7-Day Geometric Mean Permit Limit = 400 colonies/100 mL						
Shaded cells indicate an exceedance of permit limits						

Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). Potential sources of NPS within the Housatonic River watershed are described below.

Stormwater Runoff from Developed Areas

The majority of the Housatonic River watershed is undeveloped. However, approximately 25% of the land use in the watershed is considered urban, and this area is concentrated around the southern impaired segments, Lake Zoar, Lake Housatonic, and Curtiss Brook (Figures 6 and 16). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate into the soil. Studies have shown a link between increasing impervious cover and degrading water quality conditions in a watershed (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al.*, 2000).

The majority of the Housatonic River watershed (72%) has less than 6% impervious surfaces (Figure 15). However, portions of the watershed near the southern section of the watershed have a higher percentage of impervious cover (Figure 16). In particular, the area surrounding most of the Lake Housatonic impaired segment has an impervious cover consistently above 12%. Also, the entire area surrounding Curtiss Brook's impaired segment has an impervious cover consistently above 16%. While not as densely developed, there are areas where roads and other impervious surfaces are in proximity to the Lake Zoar impaired segment, and the impaired segment of the Housatonic River. The amount and proximity of impervious surfaces to the impaired segments indicates that stormwater runoff may be a source of bacteria to the Housatonic River, Lake Zoar, Lake Housatonic, and Curtiss Brook impaired segments (Figure 17).

Figure 15: Range of impervious cover (%) in the Housatonic River watershed

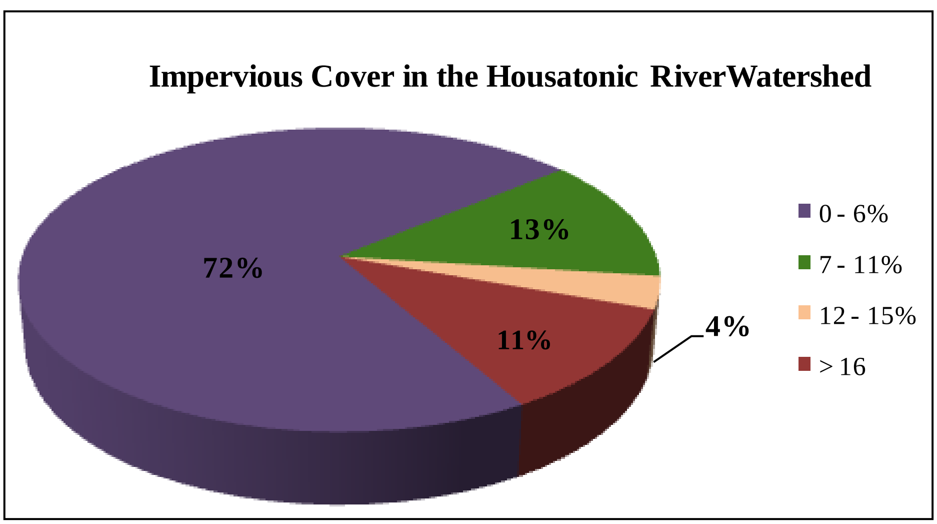


Figure 16: Impervious cover (%) for the Housatonic River sub-regional watershed, showing the Housatonic River's impaired segment

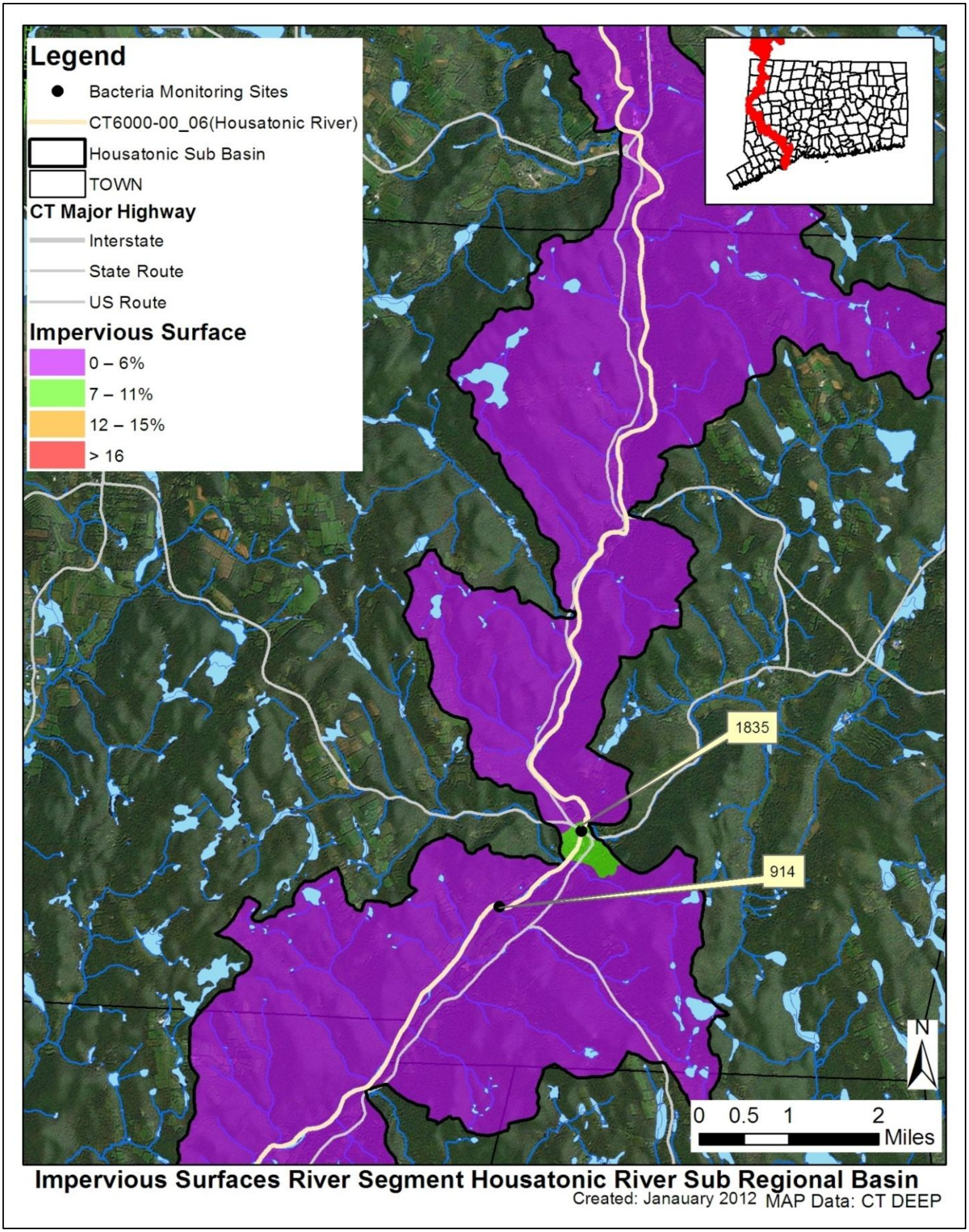
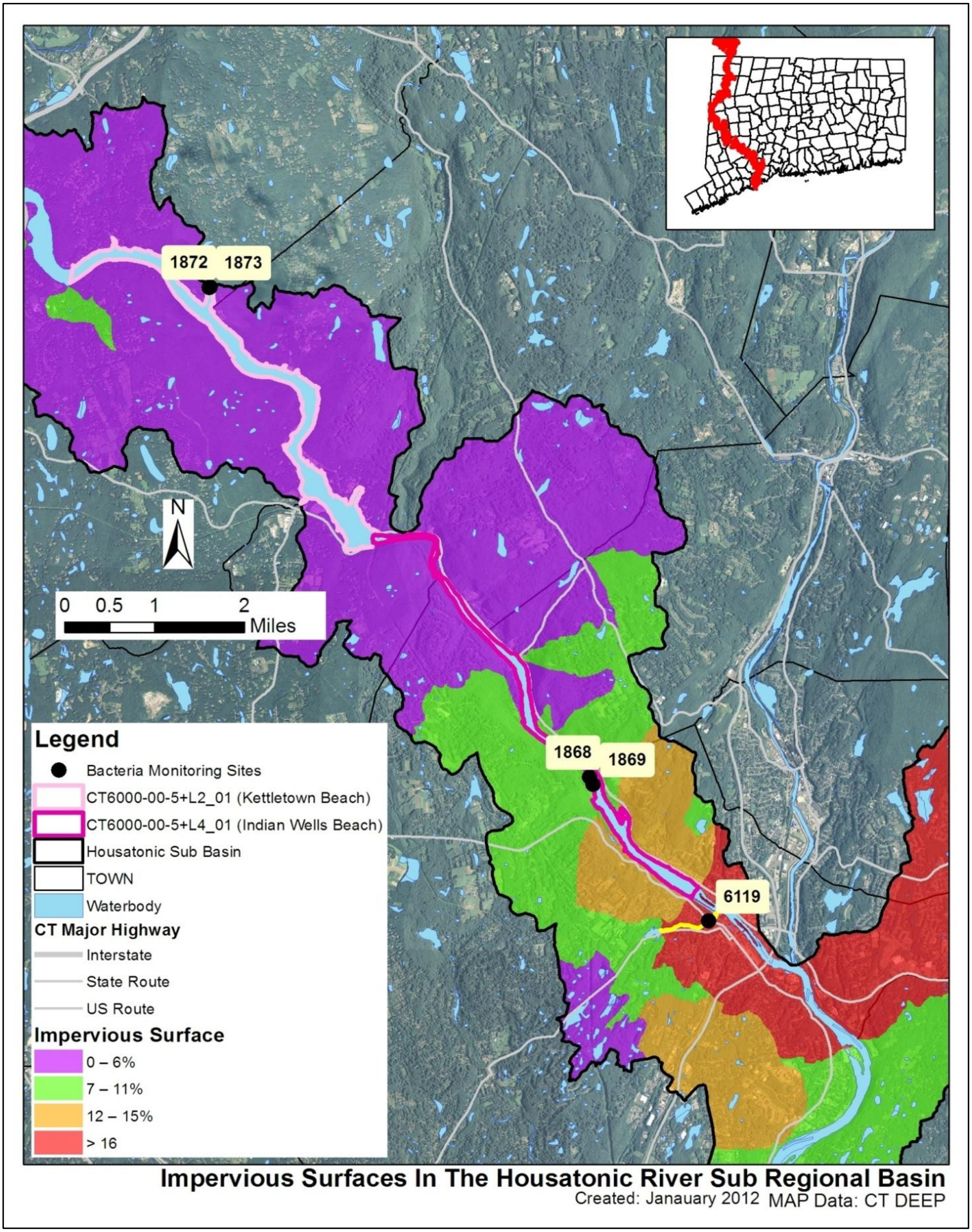


Figure 17: Impervious cover (%) for the Housatonic River sub-regional watershed, showing the Lake Zoar, Lake Housatonic, and Curtiss Brook impaired segments



Insufficient Septic Systems and Illicit Discharges

As shown in Figure 9, only the southern portion of the watershed relies on the municipal sewer system. The majority of the watershed including the area surrounding the impaired segment of the Housatonic River and Lake Zoar rely entirely on onsite wastewater treatment systems, such as septic systems. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. The Towns of Kent, Cornwall, Salisbury, and Canaan along the impaired segment of the Housatonic River are part of the Torrington Area Health District (http://www.tahd.org/). The Town of Sharon along the impaired segment of the Housatonic River has its own Health Director (http://www.sharonct.org/). The Towns of Southbury and Oxford on Lake Zoar's impaired segment are part of the Pomperaug Health District (http://pomperaughealthdistrict.org/). Newtown has its own regional health district within the town (http://www.newtown-ct.gov/Public_Documents/NewtownCT_Health/index). The Town of Monroe on Lake Housatonic's impaired segment is part of the Trumbull Monroe Health District (http://www.tmhd.org/). The municipalities of Derby, Seymour, and Shelton on the Lake Housatonic impaired segment are part of the Naugatuck Valley health District (http://nvhd.org/). Curtiss Brook is within the Town of Shelton is part of the Naugatuck Valley Health District.

There are multiple areas within the watershed with access to a sanitary sewer. The entire area surrounding Curtiss Brook in Shelton has access to a sanitary sewer, and portions of Lake Housatonic's shoreline in Derby and Shelton have access as well. Sewer system leaks and other illicit discharges that are located within the watershed of the impaired segment of Curtiss Brook and Lake Housatonic could be contributing bacteria to these waterbodies.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Housatonic River watershed represent another potential source of bacteria to the impaired waterbodies. Elevated bacteria levels that are due solely to a natural population of wildlife are not subject to the WQS. Any exacerbation of wildlife population sizes or residency times influenced by human activities are subject to the CT WQS and TMDL provisions. With the construction of roads and drainage systems, these wildlife wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface waterbody. As such these physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001). As the majority of the watershed is undeveloped, wildlife waste is a potential source of bacteria in the Housatonic River watershed.

There are multiple places within the watershed with turf grass, recreational fields, or golf courses close to the impaired segments. There are fields located off River Road in Cornwall and off Warren No. 1 Turnpike in Canaan close to the impaired segment of the Housatonic River. There are large fields off Roosevelt Drive in Oxford, Indian Well Road in Shelton, and Birchbank Road in Shelton that are adjacent to Lake Housatonic. The Shelton High School athletic fields are located off Meadow Street in Shelton near the Curtiss Brook impaired segment. The Highland Golf Course is located off Wooster Street in Shelton also close to Curtiss Brook. Geese and other waterfowl are known to congregate in open areas including recreational fields, agricultural crop fields, and golf courses. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants. Much of the residential development in the watershed is located near Lake Zoar, Lake Housatonic, and Curtiss Brook.

Waste from domestic animals such as dogs, may also be contributing to bacteria concentrations in these impaired segments in the Housatonic River watershed.

Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in many areas of the state. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). Though agricultural land use makes up only 8% of the Housatonic River watershed, multiple agricultural fields and livestock farms are located near the impaired segment of the Housatonic River (Figure 4). As shown in Figure 11, there is a farm with cattle on Route 7 in Cornwall that is close to the impaired segment. There are large agricultural fields surrounding the Housatonic River's impaired segment off Kent Road S. (Route 7), and River Road in Kent. There are also large fields off Lime Rock Road and Dugway Road in Salisbury adjacent to the Housatonic River's impaired segment. There are also some agricultural areas near the Lake Housatonic impaired segment. As shown in Figure 12, there is a cattle farm located along a tributary stream to Lake Housatonic in Seymour. Agricultural runoff from these farms and others in the area is a potential source of bacteria to the Housatonic River and Lake Housatonic.

Additional Sources

There may be other sources not listed here or identified in Figures 11 and 12 that contribute to the observed water quality impairment in the Housatonic River watershed. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Land Use/Landscape

Riparian Buffer Zones

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (http://clear.uconn.edu/), which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The riparian zones for the impaired segment of the Housatonic River and Lake Zoar are mostly characterized by forested areas (Figure 18). However, there are agricultural areas and developed areas within the riparian zone of the Housatonic River's impaired segment. The riparian zone for Lake Housatonic and Curtiss Brook are predominately developed (Figure 19). As previously noted, runoff from agricultural and developed areas can contribute bacteria to nearby waterbodies. Also, waste from wildlife in non-developed areas can contribute bacteria to nearby waterbodies, though much of this waste may be treated by the natural vegetated buffer.

Figure 18: Riparian buffer zone information for the Housatonic River watershed, showing the Housatonic River's impaired segment

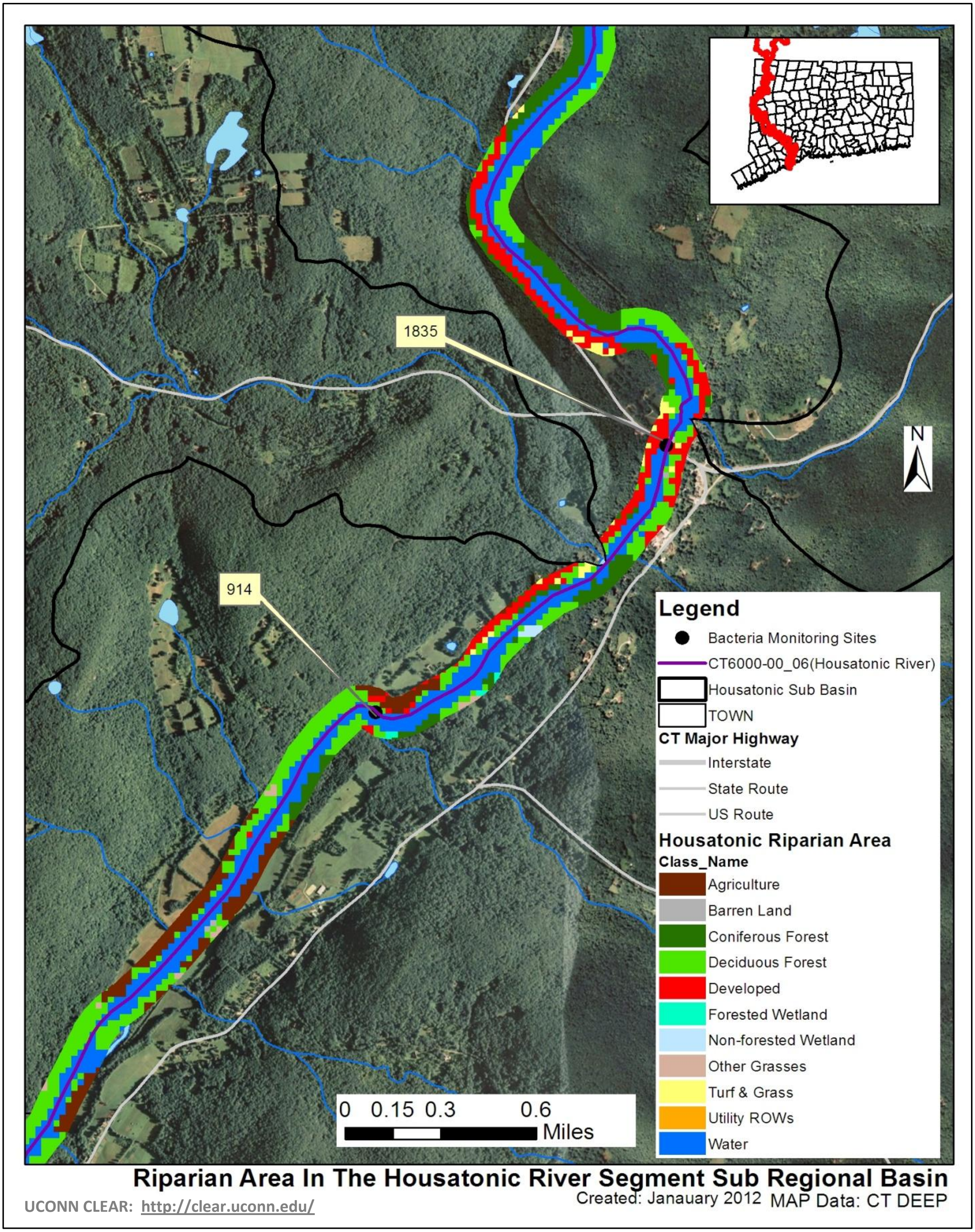
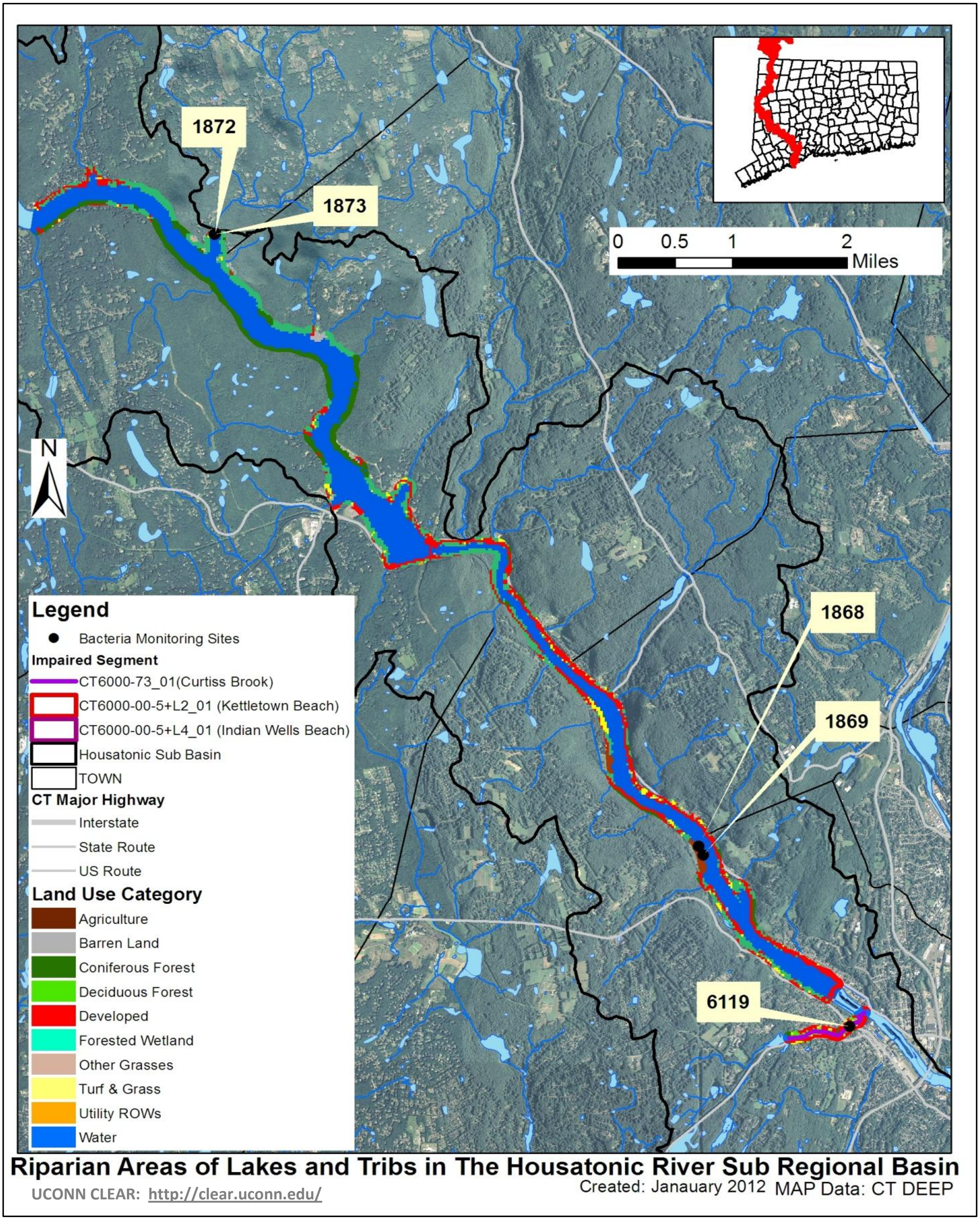


Figure 19: Riparian buffer zone information for the Housatonic River watershed, showing the Lake Zoar, Lake Housatonic, and Curtiss Brook impaired segments



CURRENT MANAGEMENT ACTIVITIES

As indicated previously, the municipalities of Derby, Shelton, Seymour, Monroe, Oxford, Newtown, and Southbury are regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the State. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in the new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each municipality is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Tables 9 – 15.

Table 9: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Derby, CT (Permit # GSM000114)

Minimum Measure	City of Derby Annual Report 2010
Public Outreach and Education	1) Brochures/fact sheets have been developed and distributed. 2) Continuing to work with webmaster to create stormwater management and information page. 3) Initiating a formal public notification program 4) In the process of developing mailing list of local business/industries.
Public Involvement and Participation	1) Continuing to actively engage community groups for clean-up and beatifying projects.
Illicit Discharge Detection and Elimination	1) Continuing to add/update language to city ordinance and zoning regulations. 2) Location and condition of outfalls documented. 3) Continuing to develop an illicit discharge program.
Construction Site Stormwater Runoff Control	1) Will add language to general permit requirements regarding notification to developers. 2) Will add language to general permit regulations regarding requirements for waste disposal on construction site.
Post Construction Stormwater Management	1) Continuing to develop program to address stormwater runoff from development. 2) Requirements for post construction management will be incorporated into zoning regulations. 3) Continuing to develop and implement BMP strategies.

Table 9: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Derby, CT (Permit # GSM000114) (continued)

Minimum Measure	City of Derby Annual Report 2010
Pollution Prevention and Good Housekeeping	1) Evaluating ways to incorporate stormwater practices into activities of the Parks Dept and facilities staff. 2) Street sweeping program completed on a yearly basis. 3) Developing a program to inspect and clean stormwater structures at least once a year.

Table 10: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Shelton, CT (Permit # GSM000045)

Minimum Measure	City of Shelton Annual Report
Public Outreach and Education	1) Completed dedicated webpage for hazardous waste disposals 2) Developed and printed pamphlet "Septic Care and Maintenance for the Homeowner".
Public Involvement and Participation	1) Continuing efforts for community service projects for trash pick up along rivers and watercourses.
Illicit Discharge Detection and Elimination	1) Mapping of stormwater outfalls completed. 2) Developing inspections to confirm location and size of stormwater outfalls.
Construction Site Stormwater Runoff Control	1) Placed DEP permit forms and instructions for Discharge of Stormwater & Dewatering Wastewater from Construction Activities in planning & zoning for distribution.
Post Construction Stormwater Management	1) Continued required use of catch basins and BMPs.
	2) Continued to require use of infiltrators/drywells to recharge groundwater and limit runoff.
Pollution Prevention and Good Housekeeping	No updates

Table 11: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Seymour, CT (Permit # GSM000009)

Minimum Measure	Town of Seymour Annual Report (2010)
Public Outreach and Education	1) Completed and distributed brochures for public education through town boards and public school system 2) Developing a library of educational materials. 3) Storm drain brochures will be distributed to local street residents as labeling is implemented.
Public Involvement and Participation	1) SWMP completed and updated in 2009. 2) Brochures created and distributed by Conservation Committee. 3) Watershed associations are being contacted to become involved in public involvement/participation.

Table 11: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Seymour, CT (Permit # GSM000009) (continued)

Minimum Measure	Town of Seymour Annual Report (2010)
Illicit Discharge Detection and Elimination	1) An illicit discharge manual has been created and used for reference and training town personnel. 2) Continuing to identify new outfalls for illicit discharges 3) Continuing to add stormwater sampling sites to original six outfalls. 4) An Illicit Discharge Detection and Elimination manual has been written for distribution and training purposes.
Construction Site Stormwater Runoff Control	1) Implemented and enforcing E/S ordinance. 2) Site inspection and enforcement of BMP measures on all town projects.
Post Construction Stormwater Management	1) Town Engineer currently reviews plans to evaluate stormwater discharges
Pollution Prevention and Good Housekeeping	1) Ongoing employee training program through Town Engineer. 2) PWD swept 100% of town's roads and parking lots. 3) PWD rebuilt/repaired 9 catch basins; installed 10 new catch basins.

Table 12: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Newtown, CT (Permit # GSM000048)

Minimum Measure	Town of Newtown Executive Summary 05-06
Public Outreach and Education	1) All annual goals have been met.
Public Involvement and Participation	1) Continue to promote stormwater discharge program @ health fair. 2) Increasing participation in waste disposal day.
Illicit Discharge Detection and Elimination	1) Continual inspection of 100% of drainage system.
Construction Site Stormwater Runoff Control	1) All goals complete during first year.
Post Construction Stormwater Management	1) All goals complete during first year.
Pollution Prevention and Good Housekeeping	1) All goals complete during first year.

Table 13: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Monroe, CT (Permit # GSM000013)

Minimum Measure	Town of Monroe Annual Report
Public Outreach and Education	1) Created stormwater hotline for information and citizen reports on polluters. 2) Continue to provide free handouts regarding stormwater quality.
Public Involvement and Participation	1) Initiated a Community Cleanup program 2) redesigned website to include links to CTDEP Stormwater Quality Manual, Guidelines for Soil Erosion & Sediment Control and CTDOT Drainage Manual. 3) Increased coordination with town schools regarding stormwater issues awareness. 4) Expanded "Dial-A-Dump" program- a service to minimize illegal dumping that could impact water quality. 5) Continuing storm drain stenciling.
Illicit Discharge Detection and Elimination	1) Initiated recycling program for household wastes such as motor oil, antifreeze, paint, pesticides, etc. 2) Developing ordinance to prohibit all non-storm water discharges into the MS4.
Construction Site Stormwater Runoff Control	1) Developed requirements for site plan reviews that incorporate consideration of potential water quality impacts.
Post Construction Stormwater Management	1) Obtained six stormwater samples.
Pollution Prevention and Good Housekeeping	1) Developed pollution prevention plan - sweeping 136 miles of paved roads. 2) Continuing to maintain town's catch basins and monitor outfalls.

Table 14: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Oxford, CT (Permit # GSM000008)

Minimum Measure	Town of Oxford Annual Report (2010)
Public Outreach and Education	1) Developed active website and information is posted. 2) Developing a library of educational materials. 3) Continuing storm drain/marking stenciling with at least 20% marked.
Public Involvement and Participation	1) Developed and updated SWMP. 2) Brochure created and distributed by the Conservation Commission/Inland Wetlands Agency. 3) Process of storm drain/marking stenciling slowed due to lack of volunteers, but is still continuing. 4) Identified and contacted all local watershed associations for their involvement level.

Table 14: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Oxford, CT (Permit # GSM000008) (continued)

Minimum Measure	Town of Oxford Annual Report (2010)
Illicit Discharge Detection and Elimination	1) Implemented non-stormwater discharge policy. 2) Storm sewer mapping is expanding and continuing. 3) Continuing to sample/test six outfalls for *E. coli.* 4) Developed an Illicit Discharge Detection and Elimination Manual for distribution and training purposes.
Construction Site Stormwater Runoff Control	1) Town has stepped up review and enforcement of new/proposed projects to ensure E/S controls are being followed. 2) Currently complies with all requirements for discharge of stormwater. 3) Continuing requirements for construction site operators to control waste at site.
Post Construction Stormwater Management	1) Continuing operation and maintenance of BMPs.
Pollution Prevention and Good Housekeeping	1) Developed curriculum for training employees. 2) Implemented and swept 100% of roads, parking lots and facilitiies. 3) Town cleaned 38% of catch basins and continued tracking this information.

Table 15: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Southbury, CT (Permit # GSM000028)

Minimum Measure	Town of Southbury Annual Report 2010
Public Outreach and Education	1) Audubon Center at Bent of the River held a variety programs on water quality, reaching over 700 school-aged children, and over 300 adults. 2) A "stormwater" page was added to Southbury's website, and the 2010 Stormwater Management Plan was posted. 3) The Town of Southbury has contributed $245,000 to Pomperaug River Watershed Coalition since 2005 in support of water quality programs, including $38,000 in 2010. 4) Storm drains along Maine Street South were marked by Boy Scout Troop 1607.
Public Involvement and Participation	1) The Pomperaug River Watershed Coalition conducted 49 programs to reach 1,429 citizens in 2009; and 69 programs to reach 2,065 citizens in 2010. 2) The Pomperaug River Watershed Coalition estimates over 280,000 people were reached through their mass media efforts. 3) Pomperaug River Watershed Coalition held a River Management Seminar for Residents in June 2008.
Illicit Discharge Detection and Elimination	1) Some stormwater inlets and outfalls were mapped in 2010, in a collaborative effort between the Pomperaug River Watershed Coalition and Town of Southbury. 2) One residential illicit discharge (leaking fuel tank) was discovered in Southbury. 3) CVS Pharmacies throughout Connecticut, including in Southbury on Bullet Hill Road, were found to have conducted illicit discharges of photo chemicals into onsite wastewater systems in 2009-10.
Construction Site Stormwater Runoff Control	1) Three subdivisions, two commercial, and seven residential plans were reviewed for municipal soil and erosion compliance in FY2009. 2) Approximately 110 site inspections by Southbury for erosion and sedimentation compliance. 3) Greatly improved permit tracking and GIS software, aerial photo data, and land use data methods were adopted by Southbury in 2010.
Post Construction Stormwater management	1) The town continued to track approximately 20 individual best management sites, including sending each year 3 clean-out reminders.
Pollution Prevention and Good Housekeeping	1) All streets were swept at least once in spring 2010, covering 244 curb miles, and removing 2,720 tons of material. 2) 150 curb miles of street were swept in fall 2010, removing 400 tons. 3) In 2009 and 2010 approximately 1,900 catch basins were cleaned using the Southbury's vacuum truck removing 1800 tons of material. 4) Southbury participated in regional Hazardous Waste & Mercury Exchange Programs in 2010. 5) Stormwater sampling at six outfalls was conducted on Sept 16, 2010.

RECOMMENDED NEXT STEPS

The municipalities of Derby, Shelton, Seymour, Monroe, Oxford, Newtown, and Southbury have developed and implemented programs to protect water quality from bacterial contamination. Any municipalities not already working with The Housatonic Valley Association (HVA) are encouraged to contact this watershed association. HVA works with volunteers groups through outreach and educational efforts including workshops and monitoring efforts. For more information see the HVA website at www.hvatoday.org. Future mitigative activities are necessary to ensure the long-term protection of the Housatonic River, Lake Zoar, Lake Housatonic, and Curtiss Brook and have been prioritized below.

1) Continue monitoring of permitted sources.

Previous sampling of discharge from permitted sources within the watershed has shown elevated levels of *E. coli* or fecal coliform bacteria, indicators of bacterial pollution (Tables 6 - 8). Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility are an additional recommendation. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within four months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established by the TMDL. For discharges to impaired waterbodies, the municipality must assess and modify the six minimum measures of its plan, if necessary, to meet TMDL standards. Particular focus should be placed on the following plan components: public education, illicit discharge detection and elimination, stormwater structures cleaning, and the repair, upgrade, or retrofit of storm sewer structures. The goal of these modifications is to establish a program that improves water quality consistent with TMDL requirements. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

Table 16 details the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Housatonic River Watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

Table 16. Bacteria (e.coli) TMDLs, WLAs, and LAs for Recreational Use

		Instantaneous *E. coli* (#/100mL)						**Geometric Mean *E. coli* (#/100mL)**	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
	Recreational Use	1	2	3	1	2	3	**All**	**All**
AA	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126
B[4]	Non-Stormwater NPDES	235	410	576				126	
	CSOs	235	410	576				126	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) Replace numeric value with “natural levels” if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

2) Identify areas in the Housatonic River watershed to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, 25% of the Housatonic River watershed is considered urban and many of the municipalities within the Housatonic River watershed are MS4 communities regulated by the MS4 program. Portions of the watershed surrounding Lake Housatonic have an impervious cover greater than

12% and areas surrounding the impaired segment of Curtiss Brook have an impervious cover of greater than 16%. There are also portions of the Housatonic River and Lake Zoar's riparian zone with development (Figure 19). As such stormwater runoff is likely contributing bacteria to the waterbodies, particularly Lake Zoar, Lake Housatonic, and Curtiss Brook. Most of the developed areas are located in the Cities of Shelton and Derby.

To identify other areas that are contributing bacteria to the impaired segments, the municipalities should continue to conduct wet-weather sampling at stormwater outfalls that discharge directly to the impaired segments in the Housatonic River watershed. Outfalls that have previously shown high bacteria concentrations should be prioritized for BMP installation (Table 7). To treat stormwater runoff, the towns should identify areas along the more developed sections of the impaired segments to install BMPs designed to encourage stormwater to infiltrate into the ground before entering the waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

3) Evaluate municipal education and outreach programs regarding animal waste.

As most of the Housatonic River watershed is undeveloped, any education and outreach program should highlight the importance of not feeding waterfowl and wildlife and managing waste from horses, dogs, and other pets. Municipalities and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the impaired segments that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Housatonic River watershed and can harm human health and the environment.

Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-uses areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

4) Ensure there are sufficient buffers on agricultural lands along the Housatonic River.

If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict livestock and horse access to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place. Particular attention should be paid to those agricultural operations located within the riparian buffer zone of the impaired segment of the Housatonic River in the northern portion of the watershed (Figure 18).

5) Implement a program to evaluate the sanitary sewer system.

Many residents and businesses surrounding the downstream portion of Lake Housatonic's impaired segment in Shelton and Derby rely on a municipal sewer system (Figure 11). All residents and businesses surrounding Curtiss Brook's impaired segment rely on a municipal sewer system. Ensuring there are no leaks or overflows from the sanitary sewer in this area should be made a priority. Many municipalities are already taking action. Derby, Shelton, Oxford, and Southbury are mapping outfalls; Derby, Seymour, Monroe, Oxford, and Southbury have developed illicit discharge detection and elimination programs; Shelton and Newtown are conducting stormwater structure inspections; and Seymour and Oxford are conducting stormwater outfall sampling at various locations. It is important for these municipalities to continue to develop programs to evaluate their sanitary sewer and reduce leaks and overflows, especially in the areas around these impaired segments. This program should include periodic inspections of the sewer line.

6) Develop a system to monitor septic systems.

Overall, only a small portion of the Housatonic River watershed has access to a municipal sanitary sewer system. Most of the area surrounding the impaired segments relies on septic systems. If not already in place, Salisbury, Canaan, Sharon, Cornwall, Kent, Southbury, Newtown, Oxford, Monroe, and Seymour should establish programs to ensure that existing septic systems are properly operated and maintained. For instance, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of the sub-standard systems within a reasonable timeframe could also be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 17: Housatonic River Bacteria Data

Waterbody ID: CT6000-00_06

Characteristics: Freshwater, Class B, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **30%**

Single Sample: **89%**

Data: 2003, 2004; 2006 - 2009 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* data (colonies/100 mL) from Station 319 on the Housatonic River with annual geometric mean calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
914	Upstream of confluence with Gunn Brook at Swifts Bridge	4/28/2003	10	dry	27
914	Upstream of confluence with Gunn Brook at Swifts Bridge	7/30/2003	10	dry	
914	Upstream of confluence with Gunn Brook at Swifts Bridge	11/17/2003	190	dry	
914	Upstream of confluence with Gunn Brook at Swifts Bridge	2/18/2004	10†	dry	NA

Single sample *E. coli* data (colonies/100 mL) from Station 319 on the Housatonic River with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/1/2006	250	dry	119
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/14/2006	41	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/29/2006	1900	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/12/2006	220	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/19/2006	41	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/26/2006	98	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/2/2006	230†	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/9/2006	75	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/14/2006	20	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/23/2006	98	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/6/2007	235†	wet	76
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/12/2007	63	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/27/2007	10	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/5/2007	97	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/10/2007	41	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/17/2007	115†	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/25/2007	20	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/2/2007	74	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/9/2007	140	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/30/2007	74†	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	9/6/2007	98	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	9/13/2007	360	wet	

Single sample *E. coli* data (colonies/100 mL) from Station 319 on the Housatonic River with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1835	Adjacent to River Road (on west bank) under Route 4 crossing	5/22/2008	41	wet	**181* (30%)**
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/5/2008	74	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/9/2008	**3600* (89%)**	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/19/2008	350	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/26/2008	175†	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/8/2008	31	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/23/2008	330	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/31/2008	103†	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/4/2008	97	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/14/2008	63	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	9/9/2008	1600	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/11/2009	110	wet	135
1835	Adjacent to River Road (on west bank) under Route 4 crossing	6/17/2009	510	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/2/2009	160	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/9/2009	41	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/16/2009	73	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	7/23/2009	410	wet	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/6/2009	110	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/12/2009	84	dry	
1835	Adjacent to River Road (on west bank) under Route 4 crossing	8/19/2009	150	dry	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 319 on the Housatonic River

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
914	Upstream of confluence with Gunn Brook at Swifts Bridge	2003-2004	0	4	21	NA	21
1835	Adjacent to River Road (on west bank) under Route 4 crossing	2006-2009	20	22	120	210	72
Shaded cells indicate an exceedance of water quality criteria							
Weather condition determined from rain gage at the Norfolk 2 SW in Norfolk, CT							

Table 18: Lake Zoar Bacteria Data

Waterbody ID: CT6000-00-05+L2_01

Characteristics: Freshwater, Class B, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, Navigation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 235 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **NA**

Single Sample: **88%**

Data: 2000 and 2002 - 2011 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* data (colonies/100 mL) from Station 1873 on Lake Zoar with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1873	Kettletown	5/23/2000	53	wet	53
1873	Kettletown	5/25/2000	42	wet	
1873	Kettletown	5/30/2000	20	dry	
1873	Kettletown	6/5/2000	10	dry	
1873	Kettletown	6/12/2000	2000	wet	
1873	Kettletown	6/14/2000	75	dry	
1873	Kettletown	6/19/2000	120	dry	
1873	Kettletown	6/21/2000	10	dry	
1873	Kettletown	6/26/2000	53	dry	
1873	Kettletown	7/5/2000	10	dry	
1873	Kettletown	7/10/2000	10	dry	
1873	Kettletown	7/17/2000	530	wet	
1873	Kettletown	7/19/2000	20	wet	
1873	Kettletown	7/24/2000	10	dry	
1873	Kettletown	7/31/2000	240	wet	
1873	Kettletown	8/2/2000	240	wet**	
1873	Kettletown	8/4/2000	120	wet	
1873	Kettletown	8/7/2000	2000	wet	
1873	Kettletown	8/9/2000	53	dry	
1873	Kettletown	8/11/2000	20	wet	
1873	Kettletown	8/14/2000	64	wet	
1873	Kettletown	8/21/2000	10[†]	dry**	
1873	Kettletown	8/28/2000	10	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1873 on Lake Zoar with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1873	Kettletown	5/20/2002	87	dry	20
1873	Kettletown	5/28/2002	10	wet	
1873	Kettletown	6/3/2002	110	dry	
1873	Kettletown	6/10/2002	190	dry	
1873	Kettletown	6/17/2002	31	wet	
1873	Kettletown	6/24/2002	10	dry	
1873	Kettletown	7/1/2002	10	dry	
1873	Kettletown	7/8/2002	10	dry	
1873	Kettletown	7/15/2002	10	dry	
1873	Kettletown	7/22/2002	10	dry	
1873	Kettletown	7/29/2002	10	dry**	
1873	Kettletown	8/5/2002	10	wet	
1873	Kettletown	8/12/2002	20	dry	
1873	Kettletown	8/19/2002	42	dry	
1873	Kettletown	8/26/2002	10	dry**	
1873	Kettletown	5/19/2003	10	dry**	60
1873	Kettletown	5/27/2003	340	wet	
1873	Kettletown	5/29/2003	150	wet**	
1873	Kettletown	6/2/2003	560	wet	
1873	Kettletown	6/4/2003	240	wet	
1873	Kettletown	6/5/2003	430	wet	
1873	Kettletown	6/9/2003	31	dry	
1873	Kettletown	6/16/2003	160	dry	
1873	Kettletown	6/23/2003	160	wet	
1873	Kettletown	6/30/2003	10	dry	
1873	Kettletown	7/7/2003	10[†]	dry	
1873	Kettletown	7/14/2003	10	dry	
1873	Kettletown	7/21/2003	10[†]	dry	
1873	Kettletown	7/28/2003	10	dry	
1873	Kettletown	8/4/2003	2000	wet	
1873	Kettletown	8/6/2003	42	wet	
1873	Kettletown	8/11/2003	87	wet	
1873	Kettletown	8/18/2003	32[†]	wet	
1873	Kettletown	8/25/2003	10	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1873 on Lake Zoar with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1873	Kettletown	5/24/2004	99	wet	19
1873	Kettletown	6/1/2004	10	wet	
1873	Kettletown	6/7/2004	10	dry	
1873	Kettletown	6/14/2004	10†	wet**	
1873	Kettletown	6/21/2004	10	dry	
1873	Kettletown	6/28/2004	10	dry	
1873	Kettletown	7/6/2004	15†	wet	
1873	Kettletown	7/12/2004	10†	wet	
1873	Kettletown	7/19/2004	10	wet**	
1873	Kettletown	7/26/2004	31	wet	
1873	Kettletown	8/2/2004	10†	wet**	
1873	Kettletown	8/9/2004	10	dry	
1873	Kettletown	8/16/2004	10	wet	
1873	Kettletown	8/23/2004	590†	wet	
1873	Kettletown	8/25/2004	81†	dry	
1873	Kettletown	8/30/2004	10	dry**	
1873	Kettletown	5/24/2005	20	wet	23
1873	Kettletown	5/31/2005	10	dry	
1873	Kettletown	6/6/2005	10	wet	
1873	Kettletown	6/13/2005	31	dry**	
1873	Kettletown	6/20/2005	10	dry	
1873	Kettletown	6/27/2005	31	dry	
1873	Kettletown	7/5/2005	42	dry	
1873	Kettletown	7/11/2005	37†	wet**	
1873	Kettletown	7/18/2005	99	wet**	
1873	Kettletown	7/25/2005	10	dry**	
1873	Kettletown	8/1/2005	26†	dry	
1873	Kettletown	8/8/2005	64	dry	
1873	Kettletown	8/15/2005	10	wet	
1873	Kettletown	8/22/2005	21†	dry	
1873	Kettletown	8/29/2005	20	wet	

Single sample *E. coli* data (colonies/100 mL) from Station 1873 on Lake Zoar with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1873	Kettletown	5/22/2006	64	dry	
1873	Kettletown	5/30/2006	31	dry	
1873	Kettletown	6/5/2006	180	dry	
1873	Kettletown	6/12/2006	87	dry	
1873	Kettletown	6/19/2006	10	wet	
1873	Kettletown	6/26/2006	480	wet	
1873	Kettletown	6/28/2006	740	wet	
1873	Kettletown	6/29/2006	1100	wet	
1873	Kettletown	7/5/2006	145†	wet	48
1873	Kettletown	7/10/2006	75	dry	
1873	Kettletown	7/17/2006	10†	dry**	
1873	Kettletown	7/24/2006	10	dry**	
1873	Kettletown	7/31/2006	10	dry	
1873	Kettletown	8/7/2006	10	dry	
1873	Kettletown	8/14/2006	10	dry	
1873	Kettletown	8/21/2006	10†	wet	
1873	Kettletown	8/28/2006	31	wet	

Single sample *E. coli* data (colonies/100 mL) from Station 1873 on Lake Zoar with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1873	Kettletown	5/21/2007	10	dry	34
1873	Kettletown	5/29/2007	20	dry**	
1873	Kettletown	6/4/2007	**2001* (88%)**	wet	
1873	Kettletown	6/6/2007	1045†	dry	
1873	Kettletown	6/7/2007	180	dry	
1873	Kettletown	6/11/2007	450	wet	
1873	Kettletown	6/13/2007	31	dry	
1873	Kettletown	6/18/2007	10	dry**	
1873	Kettletown	6/25/2007	10	dry	
1873	Kettletown	7/2/2007	10	dry**	
1873	Kettletown	7/9/2007	10	dry	
1873	Kettletown	7/16/2007	10	dry**	
1873	Kettletown	7/23/2007	10	wet	
1873	Kettletown	7/30/2007	140	wet	
1873	Kettletown	8/6/2007	10	dry**	
1873	Kettletown	8/13/2007	10	dry	
1873	Kettletown	8/20/2007	31	dry	
1873	Kettletown	8/27/2007	10	dry**	
1873	Kettletown	5/19/2008	42	dry**	32
1873	Kettletown	5/27/2008	15†	wet	
1873	Kettletown	6/2/2008	10	wet	
1873	Kettletown	6/9/2008	20	wet	
1873	Kettletown	6/16/2008	110	wet	
1873	Kettletown	6/23/2008	10	wet	
1873	Kettletown	6/30/2008	20	dry	
1873	Kettletown	7/7/2008	59†	dry	
1873	Kettletown	7/14/2008	10	wet	
1873	Kettletown	7/21/2008	10	dry	
1873	Kettletown	7/28/2008	320	wet	
1873	Kettletown	7/30/2008	160	dry	
1873	Kettletown	8/4/2008	31	dry**	
1873	Kettletown	8/11/2008	20	wet**	
1873	Kettletown	8/18/2008	150	dry**	
1873	Kettletown	8/25/2008	15†	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1873 on Lake Zoar with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1873	Kettletown	5/19/2009	10	dry	81
1873	Kettletown	5/26/2009	2000	dry**	
1873	Kettletown	5/28/2009	15†	dry	
1873	Kettletown	6/1/2009	10	dry**	
1873	Kettletown	6/8/2009	10†	dry**	
1873	Kettletown	6/15/2009	1300	wet	
1873	Kettletown	6/16/2009	250	wet	
1873	Kettletown	6/22/2009	110	wet	
1873	Kettletown	6/29/2009	75	dry	
1873	Kettletown	7/7/2009	31	wet**	
1873	Kettletown	7/13/2009	26†	dry**	
1873	Kettletown	7/20/2009	31	dry**	
1873	Kettletown	7/27/2009	110	wet**	
1873	Kettletown	8/3/2009	890	wet	
1873	Kettletown	8/4/2009	**2001* (88%)**	dry	
1873	Kettletown	8/5/2009	64	dry	
1873	Kettletown	8/10/2009	10	dry	
1873	Kettletown	8/17/2009	10	dry	
1873	Kettletown	8/24/2009	310	wet	
1873	Kettletown	8/26/2009	110	dry**	
1873	Kettletown	8/31/2009	150	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1873 on Lake Zoar with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1873	Kettletown	5/25/2010	10	dry**	26
1873	Kettletown	6/1/2010	10	dry	
1873	Kettletown	6/7/2010	240	wet	
1873	Kettletown	6/8/2010	75	dry**	
1873	Kettletown	6/14/2010	42	wet**	
1873	Kettletown	6/21/2010	20	dry	
1873	Kettletown	6/28/2010	26†	dry	
1873	Kettletown	7/6/2010	10	dry	
1873	Kettletown	7/12/2010	10	dry	
1873	Kettletown	7/19/2010	42	wet	
1873	Kettletown	7/26/2010	10	dry	
1873	Kettletown	8/2/2010	10	dry**	
1873	Kettletown	8/9/2010	10†	dry**	
1873	Kettletown	8/16/2010	41	wet	
1873	Kettletown	8/23/2010	2000	wet	
1873	Kettletown	8/25/2010	10	wet	
1873	Kettletown	8/30/2010	10	dry	
1873	Kettletown	5/23/2011	190	unknown	63
1873	Kettletown	5/25/2011	87†	unknown	
1873	Kettletown	5/31/2011	42	unknown	
1873	Kettletown	6/6/2011	10	unknown	
1873	Kettletown	6/13/2011	870†	unknown	
1873	Kettletown	6/15/2011	20	unknown	
1873	Kettletown	6/20/2011	87	unknown	
1873	Kettletown	6/27/2011	10	unknown	
1873	Kettletown	7/5/2011	150	unknown	

Single sample *E. coli* data (colonies/100 mL) from Station 1872 on Lake Zoar with annual geometric mean calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1872	Kettletown	5/23/2000	31	wet	72
1872	Kettletown	5/25/2000	59†	wet	
1872	Kettletown	5/30/2000	31	dry	
1872	Kettletown	6/5/2000	64	dry	
1872	Kettletown	6/12/2000	2000	wet	
1872	Kettletown	6/14/2000	99	dry	
1872	Kettletown	6/19/2000	160	dry	
1872	Kettletown	6/21/2000	42†	dry	
1872	Kettletown	6/26/2000	99	dry	
1872	Kettletown	7/5/2000	10	dry	
1872	Kettletown	7/10/2000	10	dry	
1872	Kettletown	7/17/2000	560	wet	
1872	Kettletown	7/19/2000	59†	wet	
1872	Kettletown	7/24/2000	20	dry	
1872	Kettletown	7/31/2000	190	wet	
1872	Kettletown	8/2/2000	110	wet**	
1872	Kettletown	8/4/2000	210†	wet	
1872	Kettletown	8/7/2000	2000	wet	
1872	Kettletown	8/9/2000	104†	dry	
1872	Kettletown	8/11/2000	10†	wet	
1872	Kettletown	8/14/2000	31	wet	
1872	Kettletown	8/21/2000	31	dry**	
1872	Kettletown	8/28/2000	20	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1872 on Lake Zoar with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1872	Kettletown	5/20/2002	53	dry	20
1872	Kettletown	5/28/2002	10	wet	
1872	Kettletown	6/3/2002	99	dry	
1872	Kettletown	6/10/2002	87	dry	
1872	Kettletown	6/17/2002	10	wet	
1872	Kettletown	6/24/2002	10	dry	
1872	Kettletown	7/1/2002	10	dry	
1872	Kettletown	7/8/2002	31	dry	
1872	Kettletown	7/15/2002	10	dry	
1872	Kettletown	7/22/2002	10	dry	
1872	Kettletown	7/29/2002	20	dry**	
1872	Kettletown	8/5/2002	20	wet	
1872	Kettletown	8/12/2002	10	dry	
1872	Kettletown	8/19/2002	64	dry	
1872	Kettletown	8/26/2002	10	dry**	
1872	Kettletown	5/19/2003	15†	dry**	66
1872	Kettletown	5/27/2003	320	wet	
1872	Kettletown	5/29/2003	110	wet**	
1872	Kettletown	6/2/2003	830	wet	
1872	Kettletown	6/4/2003	290†	wet	
1872	Kettletown	6/5/2003	435†	wet	
1872	Kettletown	6/9/2003	75	dry	
1872	Kettletown	6/16/2003	160	dry	
1872	Kettletown	6/23/2003	110	wet	
1872	Kettletown	6/30/2003	10	dry	
1872	Kettletown	7/7/2003	10	dry	
1872	Kettletown	7/14/2003	10†	dry	
1872	Kettletown	7/21/2003	10	dry	
1872	Kettletown	7/28/2003	10†	dry	
1872	Kettletown	8/4/2003	2000†	wet	
1872	Kettletown	8/6/2003	110	wet	
1872	Kettletown	8/11/2003	70†	wet	
1872	Kettletown	8/18/2003	31	wet	
1872	Kettletown	8/25/2003	10	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1872 on Lake Zoar with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1872	Kettletown	5/24/2004	31	wet	14
1872	Kettletown	6/1/2004	10	wet	
1872	Kettletown	6/7/2004	10	dry	
1872	Kettletown	6/14/2004	10	wet**	
1872	Kettletown	6/21/2004	10	dry	
1872	Kettletown	6/28/2004	10†	dry	
1872	Kettletown	7/6/2004	10	wet	
1872	Kettletown	7/12/2004	10	wet	
1872	Kettletown	7/19/2004	10†	wet**	
1872	Kettletown	7/26/2004	10†	wet	
1872	Kettletown	8/2/2004	10	wet**	
1872	Kettletown	8/9/2004	10†	dry	
1872	Kettletown	8/16/2004	10	wet	
1872	Kettletown	8/23/2004	430	wet	
1872	Kettletown	8/25/2004	10	dry	
1872	Kettletown	8/30/2004	20	dry**	
1872	Kettletown	5/24/2005	10	wet	18
1872	Kettletown	5/31/2005	15†	dry	
1872	Kettletown	6/6/2005	10	wet	
1872	Kettletown	6/13/2005	53	dry**	
1872	Kettletown	6/20/2005	10	dry	
1872	Kettletown	6/27/2005	20	dry	
1872	Kettletown	7/5/2005	26†	dry	
1872	Kettletown	7/11/2005	87	wet**	
1872	Kettletown	7/18/2005	26†	wet**	
1872	Kettletown	7/25/2005	10	dry**	
1872	Kettletown	8/1/2005	10	dry	
1872	Kettletown	8/8/2005	10	dry	
1872	Kettletown	8/15/2005	20	wet	
1872	Kettletown	8/22/2005	42	dry	
1872	Kettletown	8/29/2005	10	wet	

Single sample *E. coli* data (colonies/100 mL) from Station 1872 on Lake Zoar with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1872	Kettletown	5/22/2006	70†	dry	63
1872	Kettletown	5/30/2006	10	dry	
1872	Kettletown	6/5/2006	220	dry	
1872	Kettletown	6/12/2006	120†	dry	
1872	Kettletown	6/19/2006	20	wet	
1872	Kettletown	6/26/2006	610†	wet	
1872	Kettletown	6/28/2006	780	wet	
1872	Kettletown	6/29/2006	1700	wet	
1872	Kettletown	7/5/2006	180	wet	
1872	Kettletown	7/10/2006	31	dry	
1872	Kettletown	7/17/2006	10	dry**	
1872	Kettletown	7/24/2006	20	dry**	
1872	Kettletown	7/31/2006	10	dry	
1872	Kettletown	8/7/2006	10†	dry	
1872	Kettletown	8/14/2006	10	dry	
1872	Kettletown	8/21/2006	64	wet	
1872	Kettletown	8/28/2006	175†	wet	

Single sample *E. coli* data (colonies/100 mL) from Station 1872 on Lake Zoar with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1872	Kettletown	5/21/2007	31	dry	33
1872	Kettletown	5/29/2007	31	dry**	
1872	Kettletown	6/4/2007	**2001* (88%)**	wet	
1872	Kettletown	6/6/2007	890	dry	
1872	Kettletown	6/7/2007	110	dry	
1872	Kettletown	6/11/2007	31	wet	
1872	Kettletown	6/13/2007	42	dry	
1872	Kettletown	6/18/2007	10†	dry**	
1872	Kettletown	6/25/2007	10	dry	
1872	Kettletown	7/2/2007	10†	dry**	
1872	Kettletown	7/9/2007	15†	dry	
1872	Kettletown	7/16/2007	10	dry**	
1872	Kettletown	7/23/2007	21†	wet	
1872	Kettletown	7/30/2007	140	wet	
1872	Kettletown	8/6/2007	10	dry**	
1872	Kettletown	8/13/2007	20	dry	
1872	Kettletown	8/20/2007	10	dry	
1872	Kettletown	8/27/2007	10	dry**	
1872	Kettletown	5/19/2008	20	dry**	22
1872	Kettletown	5/27/2008	20	wet	
1872	Kettletown	6/2/2008	10	wet	
1872	Kettletown	6/9/2008	10	wet	
1872	Kettletown	6/16/2008	160	wet	
1872	Kettletown	6/23/2008	10	wet	
1872	Kettletown	6/30/2008	20	dry	
1872	Kettletown	7/7/2008	20	dry	
1872	Kettletown	7/14/2008	20	wet	
1872	Kettletown	7/21/2008	10	dry	
1872	Kettletown	7/28/2008	87	wet	
1872	Kettletown	7/30/2008	42	dry	
1872	Kettletown	8/4/2008	10	dry**	
1872	Kettletown	8/11/2008	10†	wet**	
1872	Kettletown	8/18/2008	140	dry**	
1872	Kettletown	8/25/2008	10	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1872 on Lake Zoar with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1872	Kettletown	5/19/2009	10	dry	73
1872	Kettletown	5/26/2009	1200	dry**	
1872	Kettletown	5/28/2009	31	dry	
1872	Kettletown	6/1/2009	10	dry**	
1872	Kettletown	6/8/2009	10	dry**	
1872	Kettletown	6/15/2009	1700	wet	
1872	Kettletown	6/16/2009	53	wet	
1872	Kettletown	6/22/2009	64	wet	
1872	Kettletown	6/29/2009	31	dry	
1872	Kettletown	7/7/2009	10	wet**	
1872	Kettletown	7/13/2009	10	dry**	
1872	Kettletown	7/20/2009	31	dry**	
1872	Kettletown	7/27/2009	64	wet**	
1872	Kettletown	8/3/2009	950	wet	
1872	Kettletown	8/4/2009	**2001* (88%)**	dry	
1872	Kettletown	8/5/2009	64	dry	
1872	Kettletown	8/10/2009	31	dry	
1872	Kettletown	8/17/2009	63	dry	
1872	Kettletown	8/24/2009	450	wet	
1872	Kettletown	8/26/2009	59†	dry**	
1872	Kettletown	8/31/2009	150	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1872 on Lake Zoar with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1872	Kettletown	5/25/2010	10	dry**	26
1872	Kettletown	6/1/2010	10	dry	
1872	Kettletown	6/7/2010	345†	wet	
1872	Kettletown	6/8/2010	20	dry**	
1872	Kettletown	6/14/2010	20	wet**	
1872	Kettletown	6/21/2010	10	dry	
1872	Kettletown	6/28/2010	20	dry	
1872	Kettletown	7/6/2010	20	dry	
1872	Kettletown	7/12/2010	10	dry	
1872	Kettletown	7/19/2010	10†	wet	
1872	Kettletown	7/26/2010	31	dry	
1872	Kettletown	8/2/2010	10	dry**	
1872	Kettletown	8/9/2010	10	dry**	
1872	Kettletown	8/16/2010	85	wet	
1872	Kettletown	8/23/2010	1700	wet	
1872	Kettletown	8/25/2010	15†	wet	
1872	Kettletown	8/30/2010	26†	dry	
1872	Kettletown	5/23/2011	215†	unknown	43
1872	Kettletown	5/25/2011	120	unknown	
1872	Kettletown	5/31/2011	10	unknown	
1872	Kettletown	6/6/2011	10	unknown	
1872	Kettletown	6/13/2011	31	unknown	
1872	Kettletown	6/15/2011	42	unknown	
1872	Kettletown	6/20/2011	150	unknown	
1872	Kettletown	6/27/2011	10	unknown	
1872	Kettletown	7/5/2011	99†	unknown	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 1873 and Station 1872 on Lake Zoar

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1873	Kettletown	2000, 2002-2010	72	105	38	74	23
1872	Kettletown	2000, 2002-2010	72	105	42	68	24
Shaded cells indicate an exceedance of water quality criteria							
Weather condition determined from rain gages in Danbury, CT and at Hartford Bradley International Airport							

Table 19: Lake Housatonic Bacteria Data

Waterbody ID: CT6000-00-05+L4_01

Characteristics: Freshwater, Class B, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, Navigation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 235 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **NA**

Single Sample: **88%**

Data: 2000 and 2002 - 2011 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* data (colonies/100 mL) from Station 1869 on Lake Housatonic with annual geometric mean calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1869	Indian Well	5/23/2000	10	wet	
1869	Indian Well	5/30/2000	10	dry	
1869	Indian Well	6/5/2000	10	dry	
1869	Indian Well	6/12/2000	220	wet	
1869	Indian Well	6/14/2000	120	dry	
1869	Indian Well	6/19/2000	42	dry	
1869	Indian Well	6/26/2000	10	dry	
1869	Indian Well	7/5/2000	75	dry	
1869	Indian Well	7/10/2000	10	dry	
1869	Indian Well	7/17/2000	780	wet	38
1869	Indian Well	7/19/2000	64	wet	
1869	Indian Well	7/24/2000	10	dry	
1869	Indian Well	7/31/2000	99	wet	
1869	Indian Well	8/2/2000	180	wet**	
1869	Indian Well	8/7/2000	320	wet	
1869	Indian Well	8/9/2000	10	dry	
1869	Indian Well	8/14/2000	53	wet	
1869	Indian Well	8/21/2000	10	dry**	
1869	Indian Well	8/28/2000	10	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1869 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1869	Indian Well	5/20/2002	170†	dry	30
1869	Indian Well	5/22/2002	31	dry**	
1869	Indian Well	5/28/2002	99	wet	
1869	Indian Well	6/3/2002	10	dry	
1869	Indian Well	6/10/2002	87	dry	
1869	Indian Well	6/17/2002	64	wet	
1869	Indian Well	6/24/2002	42	dry	
1869	Indian Well	7/1/2002	10†	dry	
1869	Indian Well	7/8/2002	10	dry	
1869	Indian Well	7/15/2002	42	dry	
1869	Indian Well	7/22/2002	42	dry	
1869	Indian Well	7/29/2002	26†	dry**	
1869	Indian Well	8/5/2002	31	wet	
1869	Indian Well	8/12/2002	10	dry	
1869	Indian Well	8/19/2002	10	dry	
1869	Indian Well	8/26/2002	20	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1869 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1869	Indian Well	5/19/2003	31	dry**	61
1869	Indian Well	5/27/2003	210	wet	
1869	Indian Well	5/29/2003	340	wet**	
1869	Indian Well	6/2/2003	42	wet	
1869	Indian Well	6/9/2003	64	dry	
1869	Indian Well	6/16/2003	110	dry	
1869	Indian Well	6/23/2003	53	wet	
1869	Indian Well	6/30/2003	10	dry	
1869	Indian Well	7/7/2003	64	dry	
1869	Indian Well	7/14/2003	10	dry	
1869	Indian Well	7/21/2003	10	dry	
1869	Indian Well	7/28/2003	10	dry	
1869	Indian Well	8/4/2003	250	wet	
1869	Indian Well	8/6/2003	120	wet	
1869	Indian Well	8/11/2003	700	wet	
1869	Indian Well	8/13/2003	53	dry**	
1869	Indian Well	8/18/2003	700	wet	
1869	Indian Well	8/20/2003	42	dry	
1869	Indian Well	8/25/2003	10[†]	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1869 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1869	Indian Well	5/24/2004	10	wet	37
1869	Indian Well	6/1/2004	26†	wet	
1869	Indian Well	6/7/2004	31	dry	
1869	Indian Well	6/14/2004	75	wet**	
1869	Indian Well	6/21/2004	10	dry	
1869	Indian Well	6/28/2004	10	dry	
1869	Indian Well	7/6/2004	64	wet	
1869	Indian Well	7/12/2004	31	wet	
1869	Indian Well	7/19/2004	53	wet**	
1869	Indian Well	7/26/2004	64	wet	
1869	Indian Well	8/2/2004	240	wet**	
1869	Indian Well	8/4/2004	10	dry**	
1869	Indian Well	8/9/2004	10	dry	
1869	Indian Well	8/16/2004	10	wet	
1869	Indian Well	8/23/2004	530	wet	
1869	Indian Well	8/25/2004	64	dry	
1869	Indian Well	8/30/2004	160	dry**	
1869	Indian Well	5/24/2005	10	wet	18
1869	Indian Well	5/31/2005	10	dry	
1869	Indian Well	6/6/2005	20	wet	
1869	Indian Well	6/13/2005	20	dry**	
1869	Indian Well	6/20/2005	31	dry	
1869	Indian Well	6/27/2005	10	dry	
1869	Indian Well	7/5/2005	10	dry	
1869	Indian Well	7/11/2005	31	wet**	
1869	Indian Well	7/18/2005	10	wet**	
1869	Indian Well	7/25/2005	10	dry**	
1869	Indian Well	8/1/2005	42	dry	
1869	Indian Well	8/8/2005	64	dry	
1869	Indian Well	8/15/2005	20	wet	
1869	Indian Well	8/22/2005	10	dry	
1869	Indian Well	8/29/2005	47†	wet	

Single sample *E. coli* data (colonies/100 mL) from Station 1869 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1869	Indian Well	5/22/2006	31	dry	33
1869	Indian Well	5/30/2006	10	dry	
1869	Indian Well	6/5/2006	240	dry	
1869	Indian Well	6/7/2006	87	wet	
1869	Indian Well	6/12/2006	75	dry	
1869	Indian Well	6/19/2006	10	wet	
1869	Indian Well	6/26/2006	220	wet	
1869	Indian Well	7/5/2006	42	wet	
1869	Indian Well	7/10/2006	75	dry	
1869	Indian Well	7/17/2006	10	dry**	
1869	Indian Well	7/24/2006	20	dry**	
1869	Indian Well	7/31/2006	15†	dry	
1869	Indian Well	8/7/2006	20	dry	
1869	Indian Well	8/14/2006	20	dry	
1869	Indian Well	8/21/2006	20	wet	
1869	Indian Well	8/28/2006	31	wet	
1869	Indian Well	5/21/2007	31†	dry	23
1869	Indian Well	5/29/2007	10	dry**	
1869	Indian Well	6/4/2007	160	wet	
1869	Indian Well	6/11/2007	10	wet	
1869	Indian Well	6/18/2007	110	dry**	
1869	Indian Well	6/25/2007	10†	dry	
1869	Indian Well	7/2/2007	10	dry**	
1869	Indian Well	7/9/2007	31	dry	
1869	Indian Well	7/16/2007	10	dry**	
1869	Indian Well	7/23/2007	10	wet	
1869	Indian Well	7/30/2007	250	wet	
1869	Indian Well	8/1/2007	10	dry	
1869	Indian Well	8/6/2007	10	dry**	
1869	Indian Well	8/13/2007	10	dry	
1869	Indian Well	8/20/2007	31	dry	
1869	Indian Well	8/27/2007	42	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1869 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1869	Indian Well	5/19/2008	32†	dry**	48
1869	Indian Well	5/27/2008	20	wet	
1869	Indian Well	6/2/2008	10†	wet	
1869	Indian Well	6/9/2008	10†	wet	
1869	Indian Well	6/16/2008	31	wet	
1869	Indian Well	6/23/2008	480†	wet	
1869	Indian Well	6/24/2008	42	wet	
1869	Indian Well	6/30/2008	190†	dry	
1869	Indian Well	7/2/2008	31†	dry	
1869	Indian Well	7/7/2008	10	dry	
1869	Indian Well	7/14/2008	15†	wet	
1869	Indian Well	7/21/2008	10†	dry	
1869	Indian Well	7/28/2008	150†	wet	
1869	Indian Well	8/4/2008	250†	dry**	
1869	Indian Well	8/11/2008	250	wet**	
1869	Indian Well	8/13/2008	500	dry**	
1869	Indian Well	8/18/2008	64†	dry**	
1869	Indian Well	8/25/2008	20	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1869 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1869	Indian Well	5/19/2009	53	dry	62*
1869	Indian Well	5/26/2009	31	dry**	
1869	Indian Well	6/1/2009	31	dry**	
1869	Indian Well	6/8/2009	10	dry**	
1869	Indian Well	6/15/2009	310	wet	
1869	Indian Well	6/16/2009	99	wet	
1869	Indian Well	6/22/2009	150	wet	
1869	Indian Well	6/29/2009	120	dry	
1869	Indian Well	7/7/2009	31	wet**	
1869	Indian Well	7/13/2009	31	dry**	
1869	Indian Well	7/20/2009	31	dry**	
1869	Indian Well	7/27/2009	26[†]	wet**	
1869	Indian Well	8/3/2009	120	wet	
1869	Indian Well	8/10/2009	430	dry	
1869	Indian Well	8/11/2009	20	dry	
1869	Indian Well	8/17/2009	190	dry	
1869	Indian Well	8/24/2009	190	wet	
1869	Indian Well	8/31/2009	20	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1869 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1869	Indian Well	5/25/2010	10	dry**	45
1869	Indian Well	6/1/2010	26†	dry	
1869	Indian Well	6/7/2010	31	wet	
1869	Indian Well	6/14/2010	20	wet**	
1869	Indian Well	6/21/2010	87	dry	
1869	Indian Well	6/28/2010	31	dry	
1869	Indian Well	7/6/2010	10	dry	
1869	Indian Well	7/12/2010	235†	dry	
1869	Indian Well	7/14/2010	150	wet	
1869	Indian Well	7/19/2010	31	wet	
1869	Indian Well	7/26/2010	53	dry	
1869	Indian Well	8/2/2010	150	dry**	
1869	Indian Well	8/4/2010	31	dry**	
1869	Indian Well	8/9/2010	31	dry**	
1869	Indian Well	8/16/2010	180	wet	
1869	Indian Well	8/23/2010	175†	wet	
1869	Indian Well	8/30/2010	10	dry	
1869	Indian Well	5/23/2011	180	unknown	62*
1869	Indian Well	5/31/2011	42†	unknown	
1869	Indian Well	6/6/2011	10	unknown	
1869	Indian Well	6/13/2011	75	unknown	
1869	Indian Well	6/20/2011	87	unknown	
1869	Indian Well	6/27/2011	64	unknown	
1869	Indian Well	7/5/2011	110	unknown	

Single sample *E. coli* data (colonies/100 mL) from Station 1868 on Lake Housatonic with annual geometric mean calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1868	Indian Well	5/23/2000	75	wet	35
1868	Indian Well	5/30/2000	10	dry	
1868	Indian Well	6/5/2000	10	dry	
1868	Indian Well	6/12/2000	270	wet	
1868	Indian Well	6/14/2000	99	dry	
1868	Indian Well	6/19/2000	20	dry	
1868	Indian Well	6/26/2000	10	dry	
1868	Indian Well	7/5/2000	42†	dry	
1868	Indian Well	7/10/2000	10	dry	
1868	Indian Well	7/17/2000	780	wet	
1868	Indian Well	7/19/2000	31	wet	
1868	Indian Well	7/24/2000	15†	dry	
1868	Indian Well	7/31/2000	93†	wet	
1868	Indian Well	8/2/2000	125†	wet**	
1868	Indian Well	8/7/2000	142†	wet	
1868	Indian Well	8/9/2000	10	dry	
1868	Indian Well	8/14/2000	20	wet	
1868	Indian Well	8/21/2000	10	dry**	
1868	Indian Well	8/28/2000	10	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1868 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1868	Indian Well	5/20/2002	240	dry	28
1868	Indian Well	5/22/2002	44†	dry**	
1868	Indian Well	5/28/2002	37†	wet	
1868	Indian Well	6/3/2002	15†	dry	
1868	Indian Well	6/10/2002	87†	dry	
1868	Indian Well	6/17/2002	81†	wet	
1868	Indian Well	6/24/2002	87	dry	
1868	Indian Well	7/1/2002	10	dry	
1868	Indian Well	7/8/2002	10†	dry	
1868	Indian Well	7/15/2002	15†	dry	
1868	Indian Well	7/22/2002	53†	dry	
1868	Indian Well	7/29/2002	20	dry**	
1868	Indian Well	8/5/2002	10	wet	
1868	Indian Well	8/12/2002	10†	dry	
1868	Indian Well	8/19/2002	10†	dry	
1868	Indian Well	8/26/2002	21†	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1868 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1868	Indian Well	5/19/2003	10	dry**	52
1868	Indian Well	5/27/2003	315†	wet	
1868	Indian Well	5/29/2003	300†	wet**	
1868	Indian Well	6/2/2003	71†	wet	
1868	Indian Well	6/9/2003	21†	dry	
1868	Indian Well	6/16/2003	140†	dry	
1868	Indian Well	6/23/2003	21†	wet	
1868	Indian Well	6/30/2003	15†	dry	
1868	Indian Well	7/7/2003	53	dry	
1868	Indian Well	7/14/2003	10	dry	
1868	Indian Well	7/21/2003	10	dry	
1868	Indian Well	7/28/2003	10	dry	
1868	Indian Well	8/4/2003	**2000* (88%)**	wet	
1868	Indian Well	8/6/2003	110†	wet	
1868	Indian Well	8/11/2003	53	wet	
1868	Indian Well	8/13/2003	20	dry**	
1868	Indian Well	8/18/2003	560	wet	
1868	Indian Well	8/20/2003	87	dry	
1868	Indian Well	8/25/2003	10	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1868 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1868	Indian Well	5/24/2004	26†	wet	28
1868	Indian Well	6/1/2004	42	wet	
1868	Indian Well	6/7/2004	15†	dry	
1868	Indian Well	6/14/2004	10	wet**	
1868	Indian Well	6/21/2004	10†	dry	
1868	Indian Well	6/28/2004	10	dry	
1868	Indian Well	7/6/2004	20	wet	
1868	Indian Well	7/12/2004	10	wet	
1868	Indian Well	7/19/2004	75	wet**	
1868	Indian Well	7/26/2004	10	wet	
1868	Indian Well	8/2/2004	310	wet**	
1868	Indian Well	8/4/2004	10†	dry**	
1868	Indian Well	8/9/2004	10	dry	
1868	Indian Well	8/16/2004	10†	wet	
1868	Indian Well	8/23/2004	620	wet	
1868	Indian Well	8/25/2004	75	dry	
1868	Indian Well	8/30/2004	120†	dry**	
1868	Indian Well	5/24/2005	10†	wet	22
1868	Indian Well	5/31/2005	10	dry	
1868	Indian Well	6/6/2005	36†	wet	
1868	Indian Well	6/13/2005	15†	dry**	
1868	Indian Well	6/20/2005	26†	dry	
1868	Indian Well	6/27/2005	21†	dry	
1868	Indian Well	7/5/2005	20	dry	
1868	Indian Well	7/11/2005	20	wet**	
1868	Indian Well	7/18/2005	64	wet**	
1868	Indian Well	7/25/2005	26†	dry**	
1868	Indian Well	8/1/2005	53	dry	
1868	Indian Well	8/8/2005	10†	dry	
1868	Indian Well	8/15/2005	10†	wet	
1868	Indian Well	8/22/2005	42	dry	
1868	Indian Well	8/29/2005	20	wet	

Single sample *E. coli* data (colonies/100 mL) from Station 1868 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1868	Indian Well	5/22/2006	31	dry	
1868	Indian Well	5/30/2006	10†	dry	
1868	Indian Well	6/5/2006	330†	dry	
1868	Indian Well	6/7/2006	71†	wet	
1868	Indian Well	6/12/2006	53	dry	
1868	Indian Well	6/19/2006	20	wet	
1868	Indian Well	6/26/2006	190	wet	
1868	Indian Well	7/5/2006	42	wet	
1868	Indian Well	7/10/2006	32†	dry	31
1868	Indian Well	7/17/2006	10	dry**	
1868	Indian Well	7/24/2006	20	dry**	
1868	Indian Well	7/31/2006	10	dry	
1868	Indian Well	8/7/2006	20	dry	
1868	Indian Well	8/14/2006	10	dry	
1868	Indian Well	8/21/2006	31	wet	
1868	Indian Well	8/28/2006	31	wet	
1868	Indian Well	5/21/2007	31	dry	
1868	Indian Well	5/29/2007	10	dry**	
1868	Indian Well	6/4/2007	99	wet	
1868	Indian Well	6/11/2007	10†	wet	
1868	Indian Well	6/18/2007	75	dry**	
1868	Indian Well	6/25/2007	10	dry	
1868	Indian Well	7/2/2007	10	dry**	
1868	Indian Well	7/9/2007	10	dry	
1868	Indian Well	7/16/2007	10†	dry**	32
1868	Indian Well	7/23/2007	64	wet	
1868	Indian Well	7/30/2007	190†	wet	
1868	Indian Well	8/1/2007	99	dry	
1868	Indian Well	8/6/2007	180	dry**	
1868	Indian Well	8/13/2007	26†	dry	
1868	Indian Well	8/20/2007	15†	dry	
1868	Indian Well	8/27/2007	64	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1868 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1868	Indian Well	5/19/2008	140	dry**	36
1868	Indian Well	5/27/2008	10	wet	
1868	Indian Well	6/2/2008	10	wet	
1868	Indian Well	6/9/2008	20	wet	
1868	Indian Well	6/16/2008	36†	wet	
1868	Indian Well	6/23/2008	620	wet	
1868	Indian Well	6/24/2008	65†	wet	
1868	Indian Well	6/30/2008	240	dry	
1868	Indian Well	7/2/2008	10	dry	
1868	Indian Well	7/7/2008	20	dry	
1868	Indian Well	7/14/2008	31	wet	
1868	Indian Well	7/21/2008	20	dry	
1868	Indian Well	7/28/2008	99†	wet	
1868	Indian Well	8/4/2008	64	dry**	
1868	Indian Well	8/11/2008	10	wet**	
1868	Indian Well	8/13/2008	26†	dry**	
1868	Indian Well	8/18/2008	42	dry**	
1868	Indian Well	8/25/2008	10	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1868 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1868	Indian Well	5/19/2009	10†	dry	53
1868	Indian Well	5/26/2009	64	dry**	
1868	Indian Well	6/1/2009	26†	dry**	
1868	Indian Well	6/8/2009	64	dry**	
1868	Indian Well	6/15/2009	340	wet	
1868	Indian Well	6/16/2009	140†	wet	
1868	Indian Well	6/22/2009	150	wet	
1868	Indian Well	6/29/2009	120	dry	
1868	Indian Well	7/7/2009	42†	wet**	
1868	Indian Well	7/13/2009	10	dry**	
1868	Indian Well	7/20/2009	87†	dry**	
1868	Indian Well	7/27/2009	20	wet**	
1868	Indian Well	8/3/2009	120	wet	
1868	Indian Well	8/10/2009	98†	dry	
1868	Indian Well	8/11/2009	15†	dry	
1868	Indian Well	8/17/2009	26†	dry	
1868	Indian Well	8/24/2009	99	wet	
1868	Indian Well	8/31/2009	31†	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1868 on Lake Housatonic with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1868	Indian Well	5/25/2010	10	dry**	43
1868	Indian Well	6/1/2010	42	dry	
1868	Indian Well	6/7/2010	31	wet	
1868	Indian Well	6/14/2010	10	wet**	
1868	Indian Well	6/21/2010	26†	dry	
1868	Indian Well	6/28/2010	31	dry	
1868	Indian Well	7/6/2010	31	dry	
1868	Indian Well	7/12/2010	53	dry	
1868	Indian Well	7/14/2010	120†	wet	
1868	Indian Well	7/19/2010	53	wet	
1868	Indian Well	7/26/2010	10	dry	
1868	Indian Well	8/2/2010	490†	dry**	
1868	Indian Well	8/4/2010	31†	dry**	
1868	Indian Well	8/9/2010	110	dry**	
1868	Indian Well	8/16/2010	85	wet	
1868	Indian Well	8/23/2010	64	wet	
1868	Indian Well	8/30/2010	64	dry	
1868	Indian Well	5/23/2011	150	unknown	45
1868	Indian Well	5/31/2011	31	unknown	
1868	Indian Well	6/6/2011	10	unknown	
1868	Indian Well	6/13/2011	53	unknown	
1868	Indian Well	6/20/2011	120†	unknown	
1868	Indian Well	6/27/2011	31	unknown	
1868	Indian Well	7/5/2011	42	unknown	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 1869 and 1868 on Lake Housatonic

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1868	Indian Well	2000, 2002-2010	67	104	36	56	26
1869	Indian Well	2000, 2002-2010	67	104	39	64	27
Shaded cells indicate an exceedance of water quality criteria							
Weather condition determined from rain gages in Danbury, CT and at Hartford Bradley International Airport							

Table 20: Curtiss Brook Bacteria Data

Waterbody ID: CT6000-73_01

Characteristics: Freshwater, Class AA, Existing or Proposed Public Drinking Water Supply, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, Navigation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **29%**

Single Sample: **18%**

Data: 2010 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* data (colonies/100 mL) from Station 6119 on Curtiss Brook with annual geometric mean calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
6119	Route 110 crossing (# 646 condos)	5/27/2010	400	dry	**176* (29%)**
6119	Route 110 crossing (# 646 condos)	6/3/2010	160	dry	
6119	Route 110 crossing (# 646 condos)	6/11/2010	**500* (18%)**	wet	
6119	Route 110 crossing (# 646 condos)	6/18/2010	170	dry	
6119	Route 110 crossing (# 646 condos)	6/25/2010	450	dry	
6119	Route 110 crossing (# 646 condos)	7/9/2010	270	dry	
6119	Route 110 crossing (# 646 condos)	7/16/2010	290	dry	
6119	Route 110 crossing (# 646 condos)	7/23/2010	375†	wet	
6119	Route 110 crossing (# 646 condos)	7/30/2010	26†	dry	
6119	Route 110 crossing (# 646 condos)	8/6/2010	110	dry	
6119	Route 110 crossing (# 646 condos)	8/13/2010	31†	dry	
6119	Route 110 crossing (# 646 condos)	8/20/2010	140	dry	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 6119 on Curtiss Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
6119	Route 110 crossing (# 646 condos)	2010	2	10	176	433	147
Shaded cells indicate an exceedance of water quality criteria							
Weather condition determined from rain gage at Tweed KMMK station in New Haven, CT							

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